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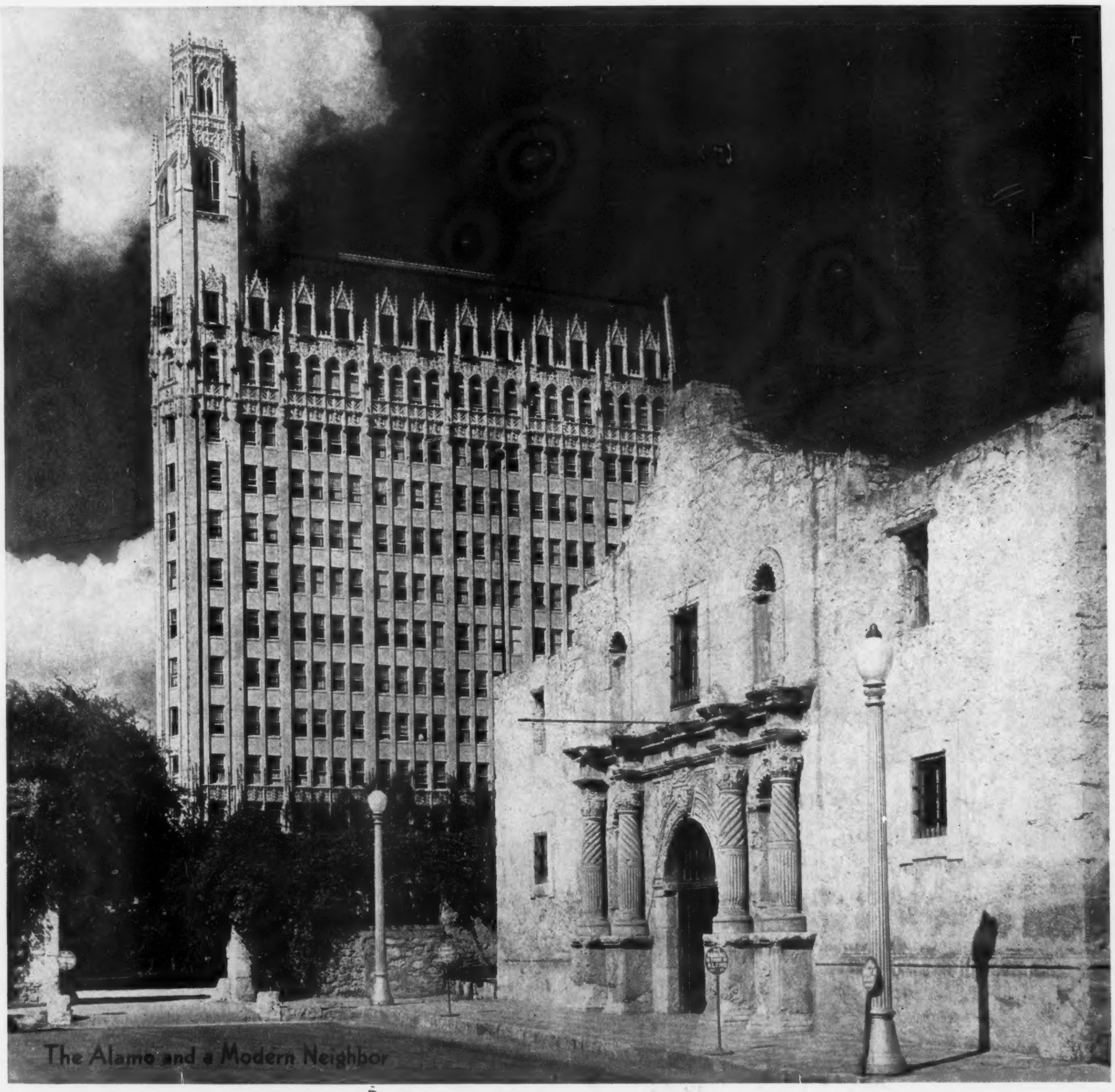

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As It Seems To Us

SUBAQUEOUS PROGRESS

PERSONS that grew up in important seaports remember the diver as one of the interesting and useful figures along the waterfront. Today the diver is a comparative rarity. The trend of construction methods has been continually towards different procedures. Pneumatic caissons have supplanted the diver in many forms of work, and the cofferdam has served to permit men literally to roll back stretches of water while they leisurely make desired changes in the bared area. An article in this issue tells the story of such an enterprise, which is noteworthy for its size. Five hundred men are working in security behind a huge watertight fence excavating for three waterways between prodigious docks. In the course of their labors they are ripping out the handiwork of divers of another decade and, incidentally, learning that those divers, though handicapped by poor vision and physical restrictions, did excellent work.

Elsewhere in these pages is a description of another device that is destined still further to limit the sphere of the diver's activities. Simon Lake's latest submarine has electric eyes, mechanical hands, and artificial lungs—a combination with which the human underwater delver will find it hard to compete. Even so, the diver is still indispensable to successful subaqueous salvage operations. As yet man's ingenuity has failed to contrive a machine that can walk into a barnacle-encrusted derelict in Davy Jones's precincts and recover treasure from the strong boxes below decks.

Prof. Auguste Piccard, famed for his exploits in the stratosphere, revealed recently that his first investigations of the cosmic rays were directed downward instead of upward and that he had even gone so far as to devise equipment for exploring the bottom of the sea. He planned to use a balloon and gondola not unlike those he employed in his aerial studies. The gondola was to have been rigid enough to withstand great pressure and the balloon was to have been filled with oil to enable it to lift the gondola to the surface after casting off ballast. Perhaps someone will yet try out his theory.

THE TREVITHICK CENTENARY

IN VIEW of the attention that is now being given to the effects of machines upon our economic and social system, it is interesting to note that England is preparing to honor the memory of Richard Trevithick on April 22, next, which is the one-hundredth anniversary of his death.

Trevithick was the first British engineer to break with conservatism, and his influence was far-reaching. His boldest act was to employ high-pressure (100 pounds) steam for the operation of non-condensing engines at a time when James Watt had already established the use of condensing engines working with pressures of about 5 pounds. This stroke paved the way for the steam locomotive; and on Christmas Eve, of 1801, a road engine of Trevithick's construction hauled the first load of passengers ever drawn by steam power. Two years later he demonstrated the use of steam locomotives in the streets of London, and in 1804 at Pen-y-daren, Wales, he introduced a tramroad engine that was able to pull 20 tons of iron. Subsequently he constructed a circular railway, in London, on which passengers were carried at speeds of twelve to fifteen miles an hour.

He is credited with having been the first man to recognize the possibilities of iron as a material for building ships. His work extended to agricultural fields, and in 1812 he built the first high-pressure steam threshing machine. Significant and thought-provoking in our times is his prediction that every phase of agricultural endeavor would be performed by machinery, and that such applications would "double the population of the kingdom and make our markets the cheapest in the world."

Trevithick's first invention was an improved plunger pole pump for deep mining; and years later he went to Peru to superintend the operation of steam engines which he had constructed for mines there. After an absence of thirteen years he returned to England where, ironically enough, he died penniless after Parliament had refused to vote him remuneration for his contributions to mechanical advancement. British engineers are now seeking to accord him posthumous acclaim, and have made a public appeal for funds with which to erect memorials to him at his birthplace in Cornwall and at two points where he first demonstrated his locomotive.

OUR COVER PICTURE

FEW structures in the United States call forth such poignant memories as the Alamo at San Antonio, Tex. Founded in 1722 as a Franciscan mission, it became, in 1836, a death trap for Texans and Americans who sought to defend it against attacking Mexicans. The Alamo has been preserved essentially as it was a century ago, and it is visited annually by hundreds of thousands of persons. Our picture, from a photograph by Harvey Patteson, shows the Alamo and a nearby modern business building—a striking study in contrasts between the old and the new.

DIAMONDS AND TRADE

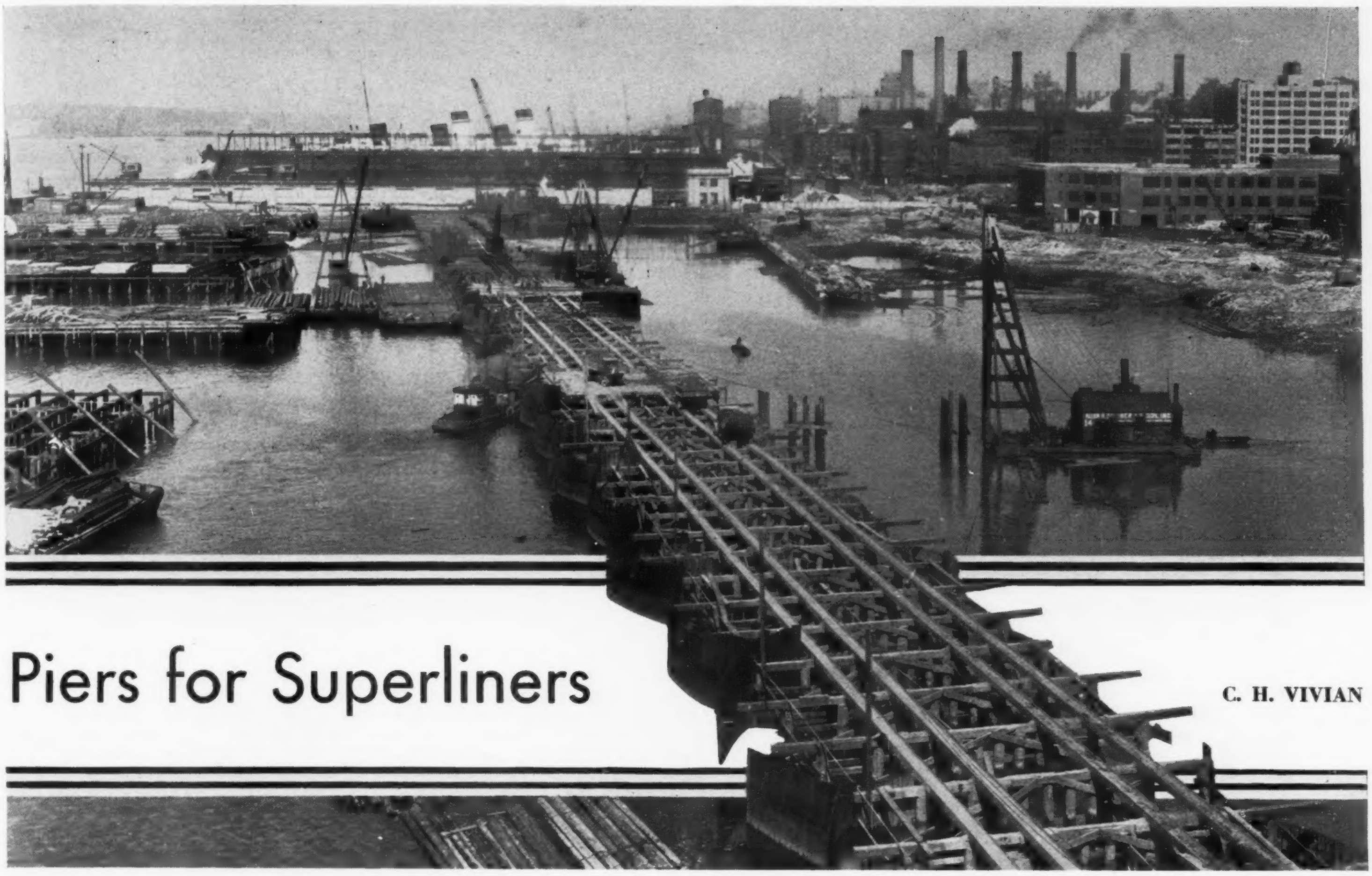
THE increase in the production of cut diamonds in recent months may be considered a hopeful harbinger of trade recovery. This is so because supply and demand are closely attuned in the diamond industry. The output of cut stones is varied from month to month, and any quickening of activity is usually a trustworthy barometer of better general conditions. Diamonds are luxury goods, and their purchase reflects not only surplus funds in the pockets of the buyers but also a conviction on their part that they will not soon require the money for more urgent needs. This applies especially to first-grade stones of one carat or larger, and it is for these that the recent demand has increased. The United States is the greatest customer of the diamond trade.

Prior to the fifteenth century, diamonds were not commercially important, and as late as 1850 the annual world consumption seldom exceeded $4,000,000 worth. Up to that time India and Brazil had been the leading sources of supply. With the discovery of the South African occurrences, in 1869, production mounted steadily, and in recent normal trade years it has ranged in value from $70,000,000 to $95,000,000. This represents an average of 7,000,000 carats of uncut diamonds, of which only a small part reaches the market as first-quality gem material. Almost half the stones are classed as bort and sold for industrial purposes, and from a third to a half of the remaining material is so poor in color or so badly flawed as to be unsuitable for the best trade. It makes showy jewelry, though, and is eagerly sought after by the people of South America, Eastern Europe, and India.

To produce an emerald-cut diamond weighing one carat you must have more than two carats of rough stone, for the cutting loss is about 55 per cent. Only about one-twentieth of the total finds is in stones of this class. If we exclude the larger stones, of from two to ten carats each, there are left only about 100,000 fine 1-carat diamonds each year. It would not seem, on the face of it, an especially difficult matter to find 100,000 customers for high-grade gems even in these times, but it is. However, demand has been allowed to govern production to such a degree that the decline in the price of diamonds has not been in proportion to that of other commodities.

Nesmith photo.

THE "Rex," of the Italian Line, being maneuvered by tugs in New York Harbor after completing her maiden voyage from Genoa. This magnificent 51,000-ton craft is a fine example of modern ship construction.



Piers for Superliners

C. H. VIVIAN

Building the cofferdam behind which an area of fifteen acres is being excavated. Steel piles are being driven toward the upper end, while trucks are already dumping earth into finished pockets. Pumps on the barge at the right unwatered the enclosed area.

New York City's Department of Docks Keeps Abreast of Ship Construction

ON the western flank of Manhattan Island, within five minutes' travel of the principal hotel district and the mid-town business section, the City of New York is building an Ocean Terminal which will provide accommodations for the largest liners now afloat or under construction. It will consist of five piers, each 1,100 feet long and 125 feet wide. These structures will be surmounted by 2-story buildings and will be arranged and equipped to handle both passengers and cargo with the greatest attainable ease and dispatch. Between them will be waterways or slips 400 feet wide and 46 feet deep, each capable of docking any two ships in existence.

The creation of this Ocean Terminal is New York's answer to the demand for more expansive docking facilities that has arisen out of the current era of superliner construction. Longer, bigger, and heavier ships have been periodically sliding down the ways of the world's shipyards and entering transatlantic service. If New York is to maintain her position as the premier port of the Seven Seas, it is obvious that she must provide suitable berths for these leviathans. There are city-owned piers in New York Harbor that are sufficiently long to do this, but they are either not fitted for this particular service or their locations are not all that is desirable. To be satisfactory in all respects for the use of the speedy and magnificent craft they are to serve, piers must be of adequate size and must also be situated where convenient to the heart of the city.

The need for better and larger docking faciliti s in New York has been a continually recurring one. When steam and iron began to supplant canvas and wood, it was impossible to foresee that ships would grow to their present proportions. Even had such growth been envisaged, it would have been uneconomical to construct docks that were far and away bigger than the then prevailing requirements. For that matter, it would have been virtually out of the question a century ago to build piers of the size we are discussing, because the engineering and construction methods that make them possible had not yet been evolved.

This steady increase in the length and bulk of ships, and the accompanying and concurrent increase in the size of the piers that New York has provided for their use, has been epitomized in graphic form by the Department of Docks by means of an artist's drawing which shows the comparative lengths of both ships and piers, arranged in the chronological order of their construction. It depicts eight vessels, each beside a dock, and was prepared under the direction of the Department's chief engineer, Francis T. O'Keefe. The following tabulation indicates this remarkable and parallel growth of ships and piers:

Year	Ship	Length	Pier Length
1872	*Oceanic*	425 feet	450 feet
1880	*Arizona*	475 "	510 "
1884	*Umbria*	500 "	530 "
1893	*Campania*	625 "	640 "
1903	*Baltic*	726 "	760 "
1910	*Olympic*	882 "	910 "
1920	*Majestic*	956 "	1,000 "
1933	*Normandie*	1,024 "	1,100 "

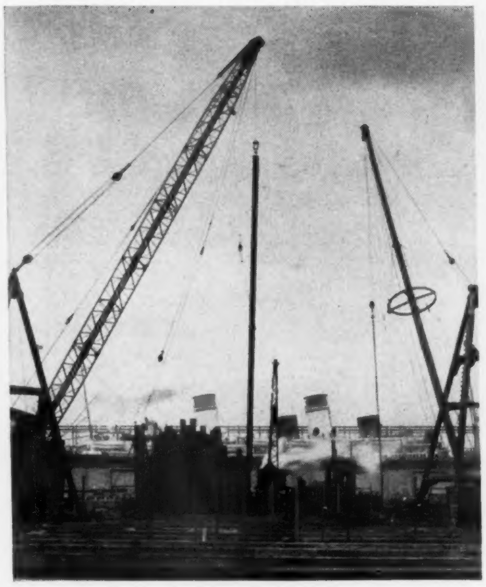
Hudson River piers comparable in length to those now under construction probably would have been built several years ago had it not been for the fact that the pierhead line, established by the United States War Department, inflexibly limited the structures to 1,000 feet. The matter of extending the pierhead line was in controversy for nearly twenty years, during which period the Government contended that further narrowing of the ship channel would unduly restrict the free movement of war vessels in times of national emergency. The possible effect of longer piers upon river currents also entered into the considerations. Finally, on January 13, 1931, the extension of the pierhead line an additional 75 feet into the river was authorized, and the city immediately

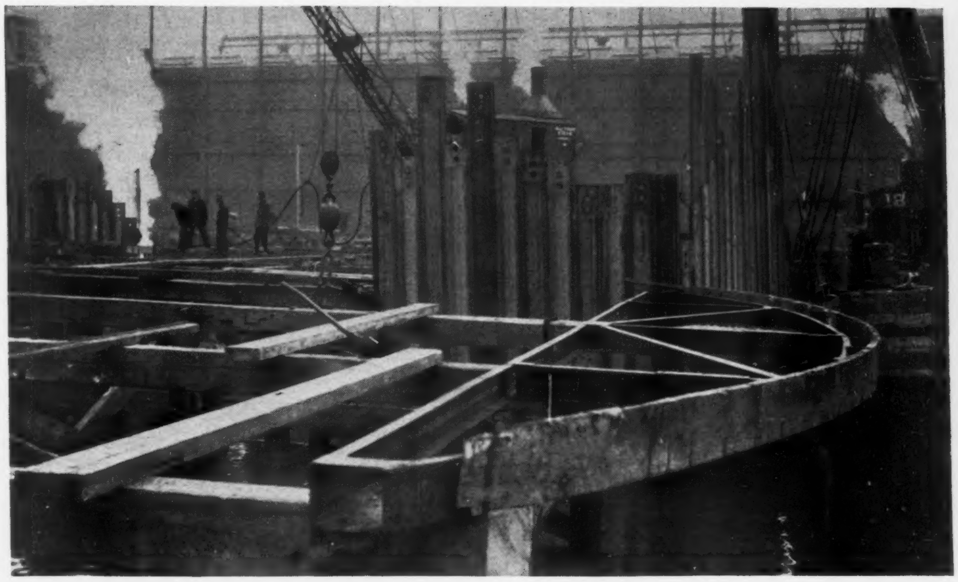
Fairchild Aerial Surveys, Inc.

An aerial view made on January 31, 1932. The cofferdam is taking form at the right-center. Below it is the pile network for the outer end of one of the new piers. Another has been started at the left.

Fairchild Aerial Surveys, Inc.

How the work looked from the air on November 27, 1932. The outer ends of the piers have been capped with concrete. They are 125 feet wide and 700 feet apart. Excavating is underway within the cofferdam.





Above—Template around which the piles were driven in the arc sections of the cofferdam.

Left—Derricks at either side lifted steel piles from scows and placed them in position for driving by a steam hammer handled by a crane between them.

went ahead with plans which previously had been held in abeyance.

The site of the New Ocean Terminal is along the riverfront between West 46th Street and West 56th Street. Both to simplify construction and to avoid putting out of service at one time all the ten short piers within that area, the undertaking was divided into two stages. The first stage, which is now underway, will account for about two-thirds of the complete terminal—that is to say, it will provide three of the five piers. It is expected that the final portion of the work will follow soon after the completion of the current work. The ultimate cost of the improvement is estimated at from $20,000,000 to $25,000,000. One of the major items involved is the purchase of property; and as considerable of this remains to be acquired at prices which are as yet undetermined, the total outlay can be only approximated.

The present construction operations extend from near West 46th Street to the northern or far side of West 52nd Street—a stretch of some 1,500 feet. As the shore line existed prior to the beginning of activities, the distance from the old bulkhead line along the waterfront to the newly extended pierhead line in the river is approximately 800 feet. Accordingly, to provide slips reaching 1,100 feet inward from the pierhead line, it became necessary to cut back into the land some 300 feet. This involved the purchase and clearing of a plot of ground lying mostly on the west or river side of Twelfth Avenue and also the relocation of the avenue itself, as it made a jog to the westward at that point.

Rock occurred at or near the surface at the eastern or landward side of the area affected and sloped irregularly downward toward the river. At the northern end, opposite 52nd Street, the slope was less pronounced than at the southern end, where the rock fell off fast. In addition, there were also local zones of irregular sizes and shapes where the rock surface was depressed. Offshore from the old bulkhead line, for a distance varying from 100 to nearly 200 feet, there was a section where rock was present at a shallower depth than the 46 feet that had been specified for the new slips.

Explorations having determined these facts, it was evident that a vast amount of rock would have to be excavated. There was little doubt that the quickest, most feasible, and most economical way of doing this would be to take out the rock in the dry, and this is the procedure that is being followed. There has been constructed what is reputed to be the largest cofferdam ever built. This consists essentially of a series of connected pockets of steel which are filled with relatively impervious earth to minimize leakage of the river water. The cofferdam is backed up on the inner side by thousands of tons of rock as an additional safeguard against failure under the tremendous pressure that is exerted against it and which will grow as the excavation within it is carried progressively deeper. The outer section of the dam extends for 1,500 feet, or more than a quarter mile. Its two end sections, which connect with the existing bulkhead line, are about 300 feet long.

The distance around the dam is roughly 2,100 feet. The area enclosed within the three sides of the structure, having the new bulkhead line for its fourth side, is approximately 640,000 square feet, or nearly fifteen acres. Save for three 125-foot-wide sections, on which the inshore portions of the piers will rest, all this immense plot is being excavated to a uniform depth of 46 feet below mean low-water level. Considerable top material is also being taken from the projecting strips so as to expose hard, stable rock as bearings for the pier support walls. All told, approximately 500,000 cubic yards of rock will be removed, which classes this undertaking as one of the largest excavation jobs ever carried out in New York. Approximately twice this yardage is being dug in making ready for the foundations of the various buildings in Rockefeller Center, but the work there is divided among a number of separate sites and is being done piecemeal.

The first step after the razing of the buildings was to remove the overlying mantle of earth from those areas under which the rock surface was depressed. In doing this, about 100,000 cubic yards of material was dredged under contract. This served not only to dispose of the dirt but also to give valuable information on the depth to rock at various points as a check upon the preliminary explorations.

With this work done, the Department of Docks, through Commissioner John McKenzie, let a contract on November 16, 1931, covering all excavating and dredging and the construction of the pier substructures. This award was made to Allen N. Spooner & Son, Inc., well-known New York contracting engineers and specialists in marine work. The bid of this firm was $4,099,000, which was nearly $2,000,000 under the estimated cost.

Erection of the cofferdam was started at once. It is made up of 43 arc pockets, each 50 feet between cross walls or diaphragms and 62 feet between the centers of the opposing arc walls. It was formed by driving Lackawanna steel piling, the arc sections being framed around a template. Through test borings, the depth to rock had been determined every few feet along the line, and it was accordingly possible to order the piles in stipulated lengths. Each piece was numbered for position at the mill. Chemical and physical tests were made at each heat during the manufacturing process and showed a tensile strength at the interlock varying from 18,000 to 24,000 pounds per linear inch, providing a wide factor of safety over the 8,000 pounds that had been specified.

Floating pile drivers drove wooden piles in advance of the dam construction, and

Right—One of the three wagon drills used for line drilling.

Below—Ten of the twelve portable compressors on the job.

Above—A rock face after line drilling and two drills in the distance. The excavation will be carried about 15 feet deeper than is shown.

Left—Shank ends of drill steels were kept fit with a 4K shank grinder.

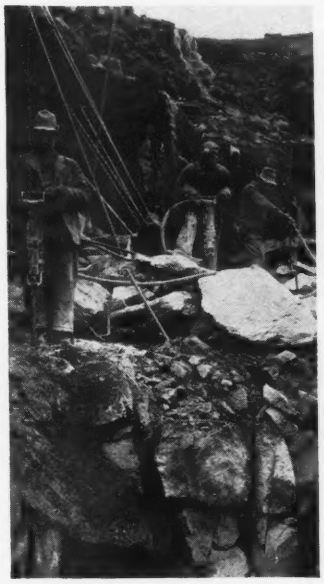
these were arranged in transverse rows at intervals of about 16 feet. They were capped with timbers, and on top of these were laid longitudinally 24-inch steel I-beams to support the two Bucyrus-Erie 41-B cranes which handled the McKiernan-Terry steam hammers used to drive the piles. After the I-beams had served this primary purpose, they were turned over on their sides to form runways for trucks along the top of the dam. Each crane traveled on a portable timber platform, picking up the timbers from behind and forming a new roadway in front as it progressed. Two floating derricks served each crane, one inside and one outside the dam. These handled the piles from the scows on which they were delivered and placed them in position for driving. The piles ranged from 46 to 95 feet in length; but the borings had determined the depth to solid material with such accuracy that their tops presented a fairly level and uniform line after they were driven. Each complete pocket required 144 piles—41 in each arc and 31 in each diaphragm. Save on the ends, each diaphragm was common to two pockets. A total of 5,200 piles was used.

It required 180,000 cubic yards of dirt to fill the pockets in the cofferdam. Sufficient suitable material was not available on the job, and much was hauled from various parts of Manhattan and even from Long Island. This phase of the work was handled by Ryan & Davis on a subcontract. Most of the riprap backing for the dam was secured from the excavation, and its deposition continued over a period of several months. All this material will have to be removed later, as will the piling and the earth in the pockets. This will be done with floating equipment after the excavation is completed—four sluiceways having been provided in the front of the cofferdam through which water can be admitted when the time arrives.

After the dam had been finished, the estimated 200,000,000 gallons of water within it was pumped out by two 10-inch gasoline-driven pumps on barges. This equipment remained on duty in the sump at the inside edge of the dam to take care of leakage and to serve in case of an emergency. The strength of the dam was amply tested last October when a storm-driven tide of 7 feet 8 inches was experienced. This was within 7 inches of the highest tide on record there. Some water slopped over the top of the barricade, but the pumps were able to handle it.

Behind this wall, which, as one of the engineers expressed it, "keeps out the Atlantic Ocean," more than 500 men are digging away at the exposed rock while at neighboring docks ships ride on the surface of the water that is many feet above the workers. This portion of the undertaking was subcontracted to Clarence L. Smith, Inc., a company that has been prominent in the New York construction field for more than 40 years. Operations are carried on 24 hours a day, with a week-end interruption from midnight Friday until midnight Sunday.

The excavating is essentially a quarrying operation, and consists of removing the rock in successive lifts or layers until the —46 level is reached. There are really three adjacent quarries, separated one from another by the projecting pier sections. At various points in these three pits are concentrated groups of men and equipment, each a unit in the larger plan. Each crew works against a face of rock from 10 to 15 feet high. Drillers on top of the benches put down vertical holes in rows parallel to the working face; and when enough of them have been drilled they are loaded with dynamite, covered with woven-wire mattresses, and fired. Shooting is done at any time of day or night, whenever the muck pile from the preceding blast gets low. Bowlders too large to handle are block holed and shot, but single pieces up to 5 or 6 tons



Left—A group of "Jackhamer" drillers in the south slip.

Below—Reconditioning drill steels in the blacksmith shop.

Above—Two of the seven power shovels at work in the north slip. In the foreground are woven-wire mats used when blasting.

Right—Two of the 36 "Jackhamers" that are employed in the work.

are removed as they are. One or more power shovels load the trucks that crawl up runways and ramps with their 10-ton burdens and emerge from the excavation on the landward side. This material is hauled out along the top of the cofferdam. Occasional loads join the rip-rap support behind the barrier. Certain selected rock of large dimensions, suitable for breakwater construction, is trucked to the outer portion of one of the old piers and there loaded into a barge. The great bulk of the spoils is dumped from a platform, just outside the center of the dam, into barges which are towed to disposal areas.

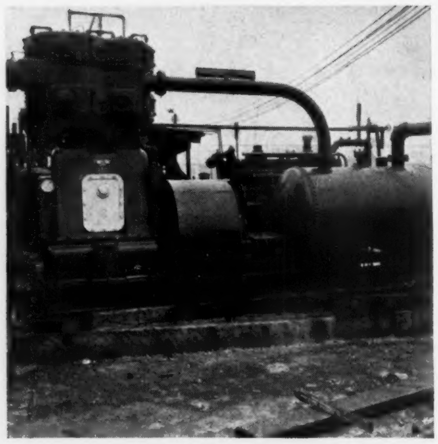
Along the sides of the jutting sections of rock on which the piers will rise and at the back of each slip area it was necessary to have solid, vertical walls of unbroken rock. This called for special treatment, for line drilling—that is, drilling a line of vertical holes so close together that the rock would break to an even face upon blasting. This was done with three Ingersoll-Rand Class D wagon drills mounted on skids. The drilling element of these machines is a powerful Type X-71 drifter drill, and each derrick is equipped with a "Utility" air hoist for elevating the drill and handling steels.

Prior to the line drilling, a few feet of badly fractured rock at the surface was removed, leaving a maximum of 40 feet to grade. Because of the slope toward the river, this depth gradually decreased along the sides of the projecting pier sections. Holes extending to —46 elevation were drilled every 12 inches along 2,900 feet of line, with a 15-foot hole midway between them. They were started with a 4-inch bit. It was estimated that the aggregate length of these holes was more than ten miles. Contrary to expectations, the rock—which is the characteristic Manhattan schist—was seamy and considerably broken in many places. This imposed difficulties upon the drills; but they gave a good account of themselves, and made as much as 400 feet of hole per machine in an 8-hour shift. Drilling in the main body of the excavation is being done with Ingersoll-Rand S-68 "Jackhamers," supplemented by one of the wagon drills mounted on a truck. There are 36 of the hand-held drills on the job. On an average, 25 of them are in operation at a time, although as many as 32 have been in use.

Drill steels are reconditioned in an outdoor lean-to shop which contains two I-R 50 sharpeners, two No. 26 oil furnaces, one No. 25 oil furnace, and a 4K shank grinder. This last-mentioned machine is a recently developed device for truing the ends of drill-steel shanks and for reducing breakage. Because of the widespread area of the working zone and the difficulties of driving a truck around it, man power has been found to be the most suitable medium for transporting steels between the shop and points of use. Four laborers are engaged in this work on each shift.

Thirteen Ingersoll-Rand compressors, which have a combined piston displacement of 5,500 cubic feet per minute, supply air for the drills and the blacksmith shop. Ten are 10x8-inch Type 20 portable units, two are Type XL portables, and one is a stationary machine of a newly introduced design known as Type PRV. It consists of a 2-stage vertical compressor having 20&12¼x12-inch cylinders, and is driven by texropes from a Waukesha 215-hp., 6-cylinder gasoline engine. The entire unit is mounted on a structural-steel base which gives it a measure of portability that adapts it well to contracting service. It has a piston displacement of approximately 1,300 cubic feet per minute. All the compressors discharge into an 8-inch line which runs along one side of the excavation and from which smaller lines are taken off, as required.

Blasted materials are loaded into trucks by seven Lorain 75 gasoline shovels equipped



Above—Looking out of a corner of the cofferdam over the rip-rap backing at a liner docked just outside.

Upper right—Some of the air is being supplied by this Type PRV semi-stationary gasoline-engine-driven vertical compressor.

Right—A Caterpillar tractor gives a loaded truck a starting boost.

with 1½-cubic-yard dippers. Two Lorain cranes, a Model 75 unit of 15 tons capacity and a Model 40 unit of 8 tons, handle the mats which are placed over all shots to prevent rocks from flying. A Caterpillar Sixty tractor equipped with a LaPlant-Choate bulldozer maintains roadways for the trucks and serves as a booster when mud gives the heavily loaded vehicles trouble in reaching the ramps and runways. Hauling is done by a fleet of 30 Mack trucks, most of them of 10 tons capacity. They make an average of ten trips to the shift and transport as many as 1,000 loads in 24 hours.

A required preliminary to the excavating was the diversion of sewers that formerly emptied into the area. This involved the laying of a line to receive the discharge from several street systems and the routing of it around the cofferdam. Much of the trenching had to be done in rock. This work was also sublet by Allen N. Spooner & Son, Inc., to Clarence L. Smith, Inc.

The old bulkhead, which is being removed as the work progresses, has created considerable interest among the engineers and workmen. Its base was composed of concrete placed in bags. Above this was a section of precast concrete blocks which was surmounted by a course of cut-granite blocks. This wall was in excellent condition despite some 40 years of service and immersion in salt water. The underwater portions were placed by divers, in contrast with the current method of excluding the water and working on dry land. This wall was built by the Department of Labor of New York City. The granite top course contained fine building stone, which has been purchased by a firm for use in construction work.

The portions of the piers beyond the —46 contour will be supported on wooden piling, and their outer ends have been completed by the Spooner forces. Following the removal of the cofferdam, they will be joined with the solid fill sections which will be carried on concrete walls varying in height from 10 to 56 feet. In building the outer ends, piles from 90 to 100 feet long, lagged to increase skin friction, were driven by floating pile drivers. These piles are from 14 to 22 inches in diameter at their upper ends and are capable of carrying 15 tons each. In addition to the piles for supporting the pier decking, others are driven in groups of 25 each to provide foundations for the columns that will carry the superstructure. These are arranged in four rows, one at either side of each pier and two equally spaced between them.

At the corner of the outer end of each pier is a group of closely spaced piles to give the structure sufficient strength to withstand the impact of huge ships being warped into dock. These piles are of greenheart timber, which grows in South America. In all, about 10,000 piles will enter into the three piers. The piers will be surfaced with a 10-inch concrete floor.

It is expected that these three outstanding piers will be ready for service next summer. They will be leased to steamship companies at self-sustaining rentals. They will be known as Piers 88, 90, and 92, numbers which are, respectively, greater by 40 than the streets at whose ends they will be situated. The extension of the new West Side Elevated Highway, which is now under construction, will pass by these piers and will make direct connections with them.

SEARCH FOR SYNTHETIC RUBBER ALSO YIELDS DRYING OIL

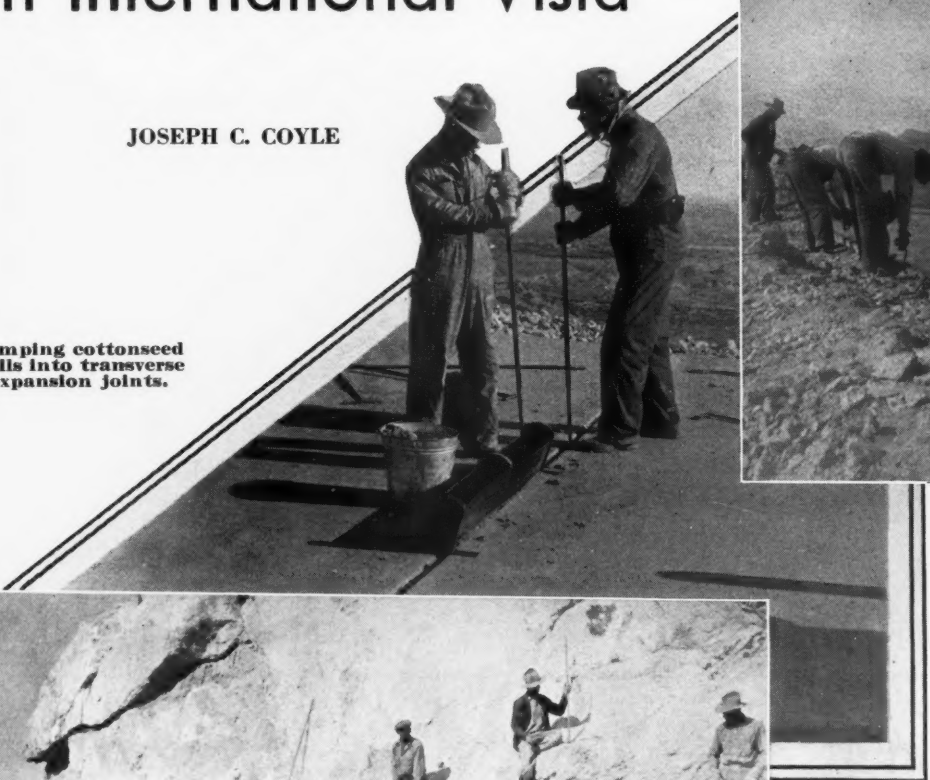
IN THE course of laboratory work that had for its object the production of synthetic rubber, the E. I. duPont de Nemours & Company also succeeded in obtaining a synthetic drying oil for which exceptional qualities are claimed. Like the rubber, it is an acetylene derivative; and bears the name S-D-O.

S-D-O, when applied to a surface properly prepared for it, is said to dry tack-free in from one to two hours and thoroughly within 48 hours. The result is a hard, transparent, amber-colored resin that is insoluble in all solvents and combination of solvents and is resistant to all but strongly oxidizing mediums. While the film is penetrated by hydrogen fluoride and hydrofluoric acid, it is uninjured by them as well as by strong acids and alkalies which tend to darken it.

Various grades of S-D-O dissolved in naphtha and containing in some cases small percentages of non-wrinkling agents are now available, together with a number of paints which, it is claimed, adhere better to metals than do the unpigmented drying oils. These various coatings can be applied to almost any but a glass and an enameled surface. Metal, in order to receive them, must first be roughened by sand-blasting or the like; but wood and concrete can be covered without preparatory treatment of any kind. Concrete floors, so protected, are not subject to wear and therefore give off no dust. Being brittle, S-D-O should not be applied to surfaces that are flexed, nor is it recommended for work exposed to rapid temperature changes.

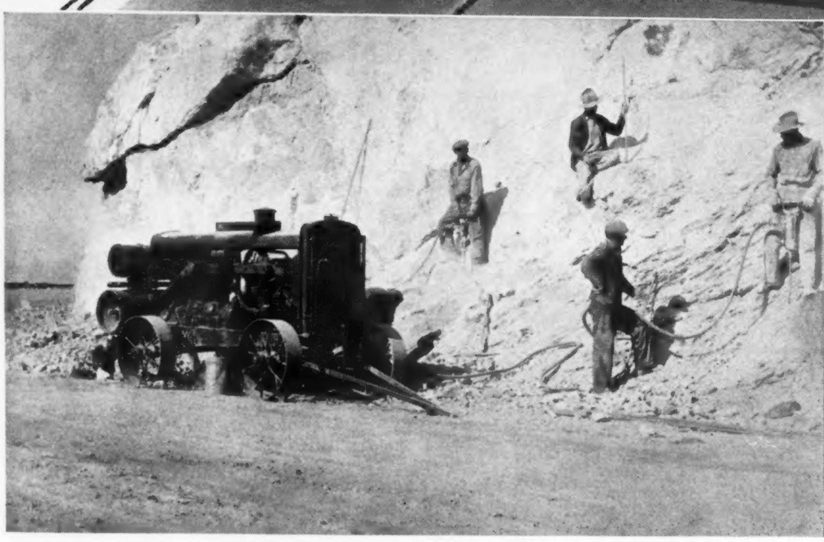
Scenic Drive Affords an International Vista

JOSEPH C. COYLE



Tamping cottonseed hulls into transverse expansion joints.

Finishing the surface and sides of the concrete.



The drilling crew that made 421 feet of hole in a day with three "Jackhamers."

AUTOMOBILE tourists who travel the southern route to or from the Pacific Coast may see all of El Paso, Tex., Jaurez, Mexico, and several miles of the Rio Grande Valley at a glance by circling Mount Franklin over a recently paved scenic driveway. At the highest point of this beautiful pleasure drive, which was carved from the rocky mountain slope with rock drills and explosives, is a wide parking space from which every street and almost every house in El Paso may be observed as from an airplane. Leaving Highway 80 at the northwest corner of El Paso, one may follow the drive, visualize these two historic cities at a glance, and again intersect any one of three U. S. Highways—70, 62, or 80—at the eastern border of El Paso. Cars going westward via any of these roads may traverse the drive and descend on to U. S. Highway 80.

The road was constructed in 1920, but had many dangerous curves. These were recently widened and banked, and the highway was also paved. The necessary funds were obtained from the Reconstruction Finance Corporation. The work was directed by the local Reconstruction Finance Corporation Committee, with J. W. Carter, El Paso County engineer, in charge. Hand labor was employed as much as possible; but as the rocky location made considerable blasting necessary, air drills were enlisted for drilling the required holes. Portable compressors supplied the air for these tools as well as for paving breakers that were used in breaking up *caliche* in drainage ditches, etc. Much secondary drilling had to be done after cliff blasting, although many of the large rocks brought down were dragged over to a dump with a chain attached to a Caterpillar tractor. One drilling crew with three "Jackhamers" and an Ingersoll-Rand Type 20 compressor drilled 421 feet of hole in a day.

Ready-mixed concrete was supplied for the paving operations from the plant of the West Texas Construction Company. Aggregates were furnished from a plant on the drive by Dudley Stone Products, Inc. Essential machinery in the mixing station consisted of a Blaw-Knox batcher which was fed by a P. & H. clamshell crane and which discharged by gravity into a Rex 1-yard mixer.

The concrete was poured into steel forms and was reinforced at each side and adjacent to each transverse joint by one strand of ½-inch steel rod. A 6-foot section of rod also was wired on an angle into each joint corner. Provision for lateral expansion was made by inserting two V-shaped metal strips at the centerline of each slab.

A novel feature of the work was the use of cottonseed hulls in the cross joints to prevent the asphalt filler from welling up during hot weather. These joints are 1½ inches wide and spaced at intervals of 80 feet. A layer of asphalt was first poured into each joint, a pail with a hole in it being employed to minimize wastage of material. Cottonseed hulls were then placed in them by means of a trough of V-shaped section, and these were consolidated by tamping with bars to a thickness of about 3 inches. A second application of asphalt was followed by another 3-inch layer of hulls. As a final operation, asphalt was poured in until it was flush with the concrete.

The periodic occurrence of sudden heavy rains in an otherwise dry region necessitated a rather deep drainage ditch along the upper side of the grade. This empties at convenient points into cross drains of corrugated Armco iron. One new drain of this type was installed near the east end of the drive, and others put in in 1920 were extended to protect the widened grade.

The main building of the three that make up the hospital unit.

Springfield, Ohio, Constructs an Outstanding Hospital

This Modern Institution Affords Every Convenience for Staff and Patients and Includes Compressed-Air Features

W. J. HEINZ

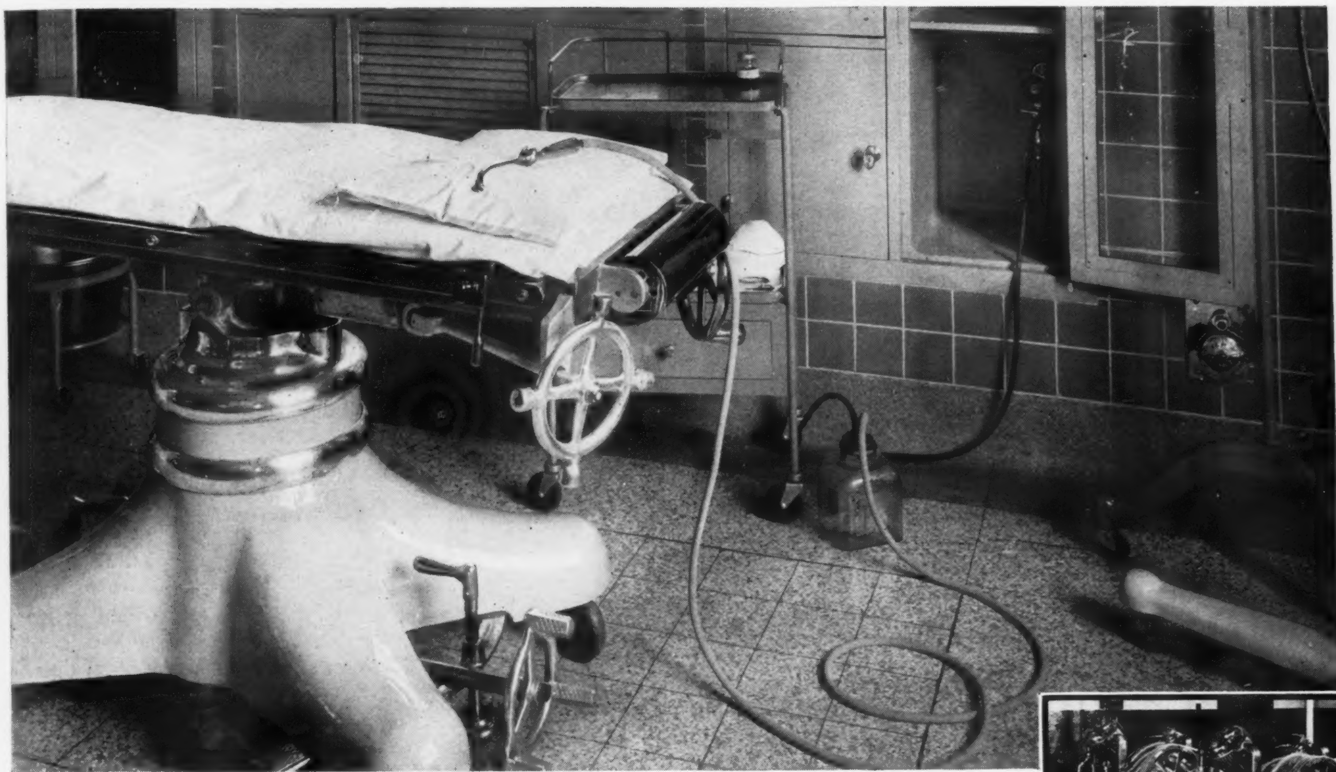
IN SPRINGFIELD, Ohio, some 10,000 cubic yards of concrete, thousands of tons of reinforcing steel, more than 21 miles of piping, and various other building materials have taken form in a group of buildings that makes up one of America's most modern hospital units—the Springfield City Hospital. From these inanimate, basic products has been reared a living monument to man's humane tempering of the first law of nature. Here, medical men will be able to enlist the most up-to-date equipment in their battle against disease and suffering. The American Hospital Association has adjudged this fine institution the outstanding hospital built in North and South America during the past year.

Down to its final detail, this unit was planned and constructed to be a model of modern hospital design and practice. It occupies a site of nearly five acres on the highest ground available to assure a maximum of light and sunshine, and on the outskirts of the city to escape noise. There are three buildings: the hospital, itself, a nurses' home, and a power plant. The main structure is modernistic in its architecture, has exterior walls of gray-buff brick trimmed with Indiana limestone, and is eleven stories high. The grounds have been attractively landscaped; and the buildings are connected underground by tunnels.

The hospital building describes a double "Y" in plan. Service stations are at the center, and in no case are they more than 70 feet away from the patients' rooms. This arrangement enables nurses to care for more patients than would be possible in a building of conventional type. Approximately 260 beds have been provided, and an effort has been made to give the rooms an atmosphere of home rather than of an institution.

The most modern surgical and dental equipment known to the medical profession has been provided without stint of money. Of unusual interest is the Drinker respirator, which derives its name from its inventor, Mr. Philip Drinker of the Harvard School of Public Health. This device is designed to induce artificial respiration in a newly born baby that fails to respond to more elementary efforts to cause it to breathe. For treatment, the infant is placed in a prone position in a small padded and warmed metal compartment with its head protruding outside through a rubber collar and supported upon a cushioned shelf. The interior of the compartment is almost airtight; and, as the pressure within it is alternately raised and lowered in synchronism with the average infantile respiratory cycle, the bodily movements of breathing are set up. As the lungs are depressed and then allowed to expand, over and over again, they draw in enough air to oxygenate and vitalize the nerve centers and organs waiting to begin their life work. This treatment is kept up until the child is breathing normally and shows every indication of continuing to do so. The baby is then removed from the respirator and given a small amount of concentrated food.

The pressure changes are effected by an accordionlike bellows which is operated by a small electric motor. A manometer gauge at the side of the compartment indicates the pressure changes; and through the manipulation of various valves the physician in charge is able to obtain the degree of action desired. This respirator, which was developed by Mr. Drinker in conjunction with Dr. Douglas P. Murphy of the University of Pennsylvania Medical School, is a leading contribution to modern medical science and



In this surgery, a compressed-air jet in the opposite wall opening provides vacuum for keeping a patient's throat free from blood during operations such as removal of tonsils.

has greatly reduced the mortality rate from infantile asphyxia. More than 100 installations have been made in this country and abroad.

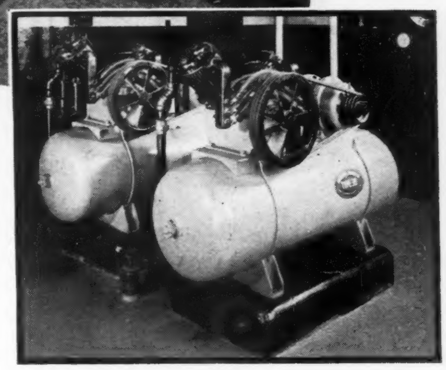
What is reputed to be the largest and most efficient X-ray machine ever developed for hospital use is installed there. The transformers which serve it are capable of generating 400,000 volts, a tension which has seldom if ever been employed for a like purpose. Located in a specially constructed, lead-lined room, the machine is so protected that its rays cannot penetrate to other rooms. The camera takes a picture in 1/120 of a second, a speed which insures immobility of the heart and lungs while photographing and which is held essential to the correct diagnosis of many bodily disorders.

The general surgery is on the eleventh floor, where good light and ventilation are assured, and is as modern as it could be made as regards both arrangement and equipment. A screen opposite the operating table makes it possible to project X-ray pictures of the patient to guide the surgeon while operating. Pressure-type sterilizers are provided for the sterilization of all surgical materials with live steam under boiler pressure.

The elevators are noteworthy for a control system which functions as though possessed with human intelligence. They are arranged for either automatic or semi-automatic operation; and, when under automatic control, a "collective push-button" type of panel is the control station. A unit consists of two cars, one of which makes the topmost floor served its "home" station while the other is normally at rest on the lowest floor served. The first attends to "down" calls and the second to "up" calls. However, if either be loaded to capacity, that particular elevator will refuse to answer signals, whereupon the other car will automatically take up its duties and act in its stead until it is again free to function normally. A car acting for another one does not slight its own service, though, and completes its calls before responding to those of its companion. In case both cars are in motion but one is in a position to answer a call sooner than the other, the latter ignores the order and returns to its home station.

If a person pushes a button for a car and then decides not to use it, the elevator proceeds to the floor; waits long enough for its door to open; and goes on to attend other calls after a certain interval. Should there be no other calls, it returns to its home station. A passenger entering a car can go to any floor by pressing the proper button.

The entire hospital unit is virtually self-reliant, as it has its own power plant, culinary department, and laundry. Among the many mechanisms installed are two 5-hp., Ingersoll-Rand Type 30 air compressors. These air-cooled, motor-driven units supply compressed air for a variety of purposes. They were chosen because their silent, trouble-free operation conforms to hospital requirements. Air compressed to 100 pounds is piped to various points for general maintenance work around the buildings. One line leads to the laundry, where the pressure is reduced to 65 pounds for operating laundry presses. Another piping system serves every surgery, laboratory, and treatment room with 30-pound air which is reduced, sometimes to as low as 2 ounces, to meet different needs. Typical users of this air are surgical and dental atomizers, blow pipes, air-jet vacuum pumps, and the laboratory, where it performs innumerable services.

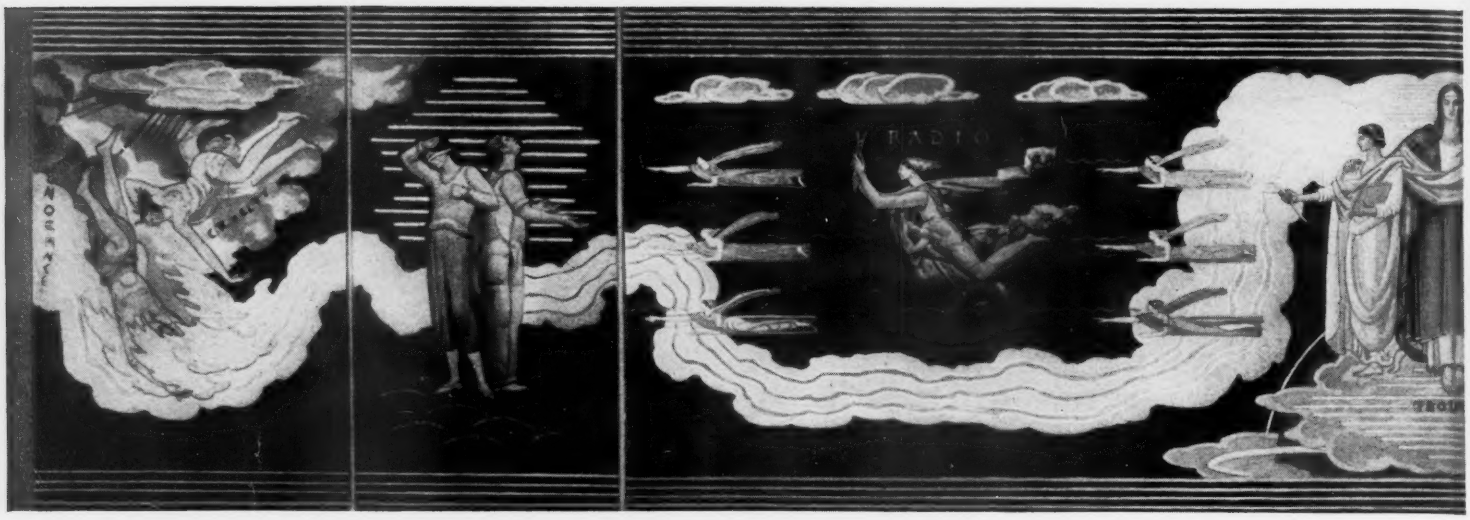


The two Type 30 compressors which supply air for numerous purposes.

The compressors have automatic stop-and-start control, and they are arranged in such a way that if air is being used so fast that the pressure continues to fall while only one machine is in operation, the other unit will cut in and continue to run until the pressure is again built up to 100 pounds, at which time both machines stop. This assures the most economical operation possible where compressors are subject to intermittent demands.

As the above photograph shows, the compressors are compact units, each mounted on its own receiver tank, thereby conserving floor space and making for a neat installation in keeping with a well-maintained power plant. As they are air cooled, no water piping is required.

The Springfield City Hospital was built under the supervision of a City Hospital Building Commission composed of nine members. Ninety-four concerns supplied equipment or services. James I. Barnes of Springfield was the general contractor. The new institution is being operated by a staff of 225 persons. It supplants an older hospital which was in service for 28 years.



Magnificent Mosaic for Rockefeller Center

Splendid Example of a Modernized Art of Great Antiquity

R. G. SKERRETT

MOSAICS, as most of us know them, are small objects of art that reproduce on a diminutive scale figures, flowers, and conventional patterns composed of many little pieces of colored enamels and kindred materials arranged with varying degrees of skill.

What, then, must one think of a mosaic designed to cover an expanse of more than 1,100 square feet and to display figures of well-nigh heroic proportions? A mosaic on this splendid scale is now in the making, and a few months hence it will adorn the loggia at the western entrance of the RCA Building in Rockefeller Center, New York City. "Intelligence Awakening Mankind" is the theme that Barry Faulkner, an eminent American artist, has chosen for expression in this outstanding panel, which will be one of the notable works of art that will make Rockefeller Center distinctive.

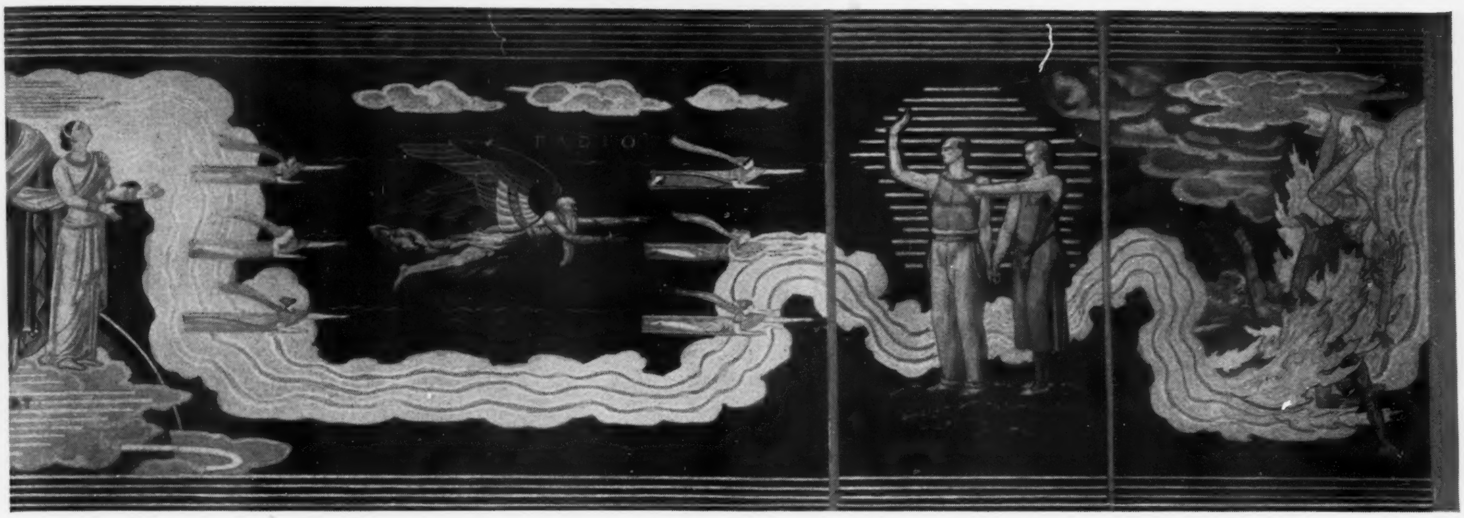
The Faulkner mosaic will measure 79 feet from end to end and 14 feet from top to bottom. It will be composed of many thousands of pieces of glass and enamel. Most of these will be rectangular in form, and the largest will probably not be more than ½ inch square. Each of these diminutive units, technically known as a tessera, will be placed by hand in its particular position in the beautiful composition. To that extent, the modern craftsman will do as his ancient fellow did who fashioned architectural mosaics hundreds and even thousands of years ago when Greece and Rome were in their classical prime, when Byzantium was in the fullness of its glory, and when the vanished civilizations of South and Central America were at the high tide of their artistic attainments. Architectural mosaics have, therefore, a lineage and a claim to recognition because of their inherent charms that have survived through cumulative centuries.

Because of the patient and painstaking manner in which mosaics were modeled in the long ago, their cost of fabrication was generally so high that they were usually produced only for religious edifices. This was the case in the glamorous days of Byzantium. Then followed a period of hundreds of years during which the art was a neglected one. When it was revived, mosaic makers centered their efforts upon the fashioning of brooches, clasps, earrings, jewel boxes, and similar bijouterie. It was not until after 1860 that the making of mosaics for architectural embellishment was resumed and, at the same time, adapted to meet contemporaneous conditions and to win a wider field of application.

Since then the industrial arts have lent a hand; and architectural mosaics today reflect this technical aid and have otherwise benefited by improvements that contribute to labor saving, to more rapid production, and to the lowering of costs. The ancient fabricator of mosaics used bits of colored marble, fragments of other stones, and such additional materials as nature had to offer him. The range of colors was, therefore, a decidedly limited one. Now the mosaist has at his command a "palette," so to speak, that has a range of nearly 10,000 hues and shades, to which are added gold, silver, and copper tesserae of various lustrous colors. Modern mosaists have, besides, tesserae of different textures; and with the wealth of materials at their disposal it is possible for them to give remarkable interpretations of the designs of artists. No wonder, then, mural mosaics are winning steadily widening favor among architects. Even though a mosaic may be a somewhat expensive form of decoration, still the first cost is offset by durability and the ease with which it can be cleaned and made to look like new.

Before we deal with Barry Faulkner's work in preparing his original sketch and in providing enlarged drawings for the guidance of the mosaist, and before telling how the latter craftsman proceeds in translating the artist's conception into the form of a mosaic, it might be well to describe how the materials are manufactured from which the tesserae are cut. The making of the glass and the enamels is, for the most part, the outcome of years of experimenting and the use of patiently developed formulae that are guarded jealously. The factory must be in a position to reproduce with sufficient accuracy prescribed colors and shades of those colors. The batch of raw materials for a given glass or enamel is put in a fire-clay pot capable of holding from 40 to 60 pounds. Many such pots, each to yield a certain hue, will occupy the melting furnace at one time. In a typically modern plant the furnace is fired by gas; and the gas is compressed so that it can be fed to the furnace and regulated to give the right temperature. Temperature plays an important part in producing glasses and enamels of definite shades. Reds and certain flesh tints owe their warmth to an admixture of gold, and as much as $5 worth of the precious metal may go into a pot to insure the desired tint.

With the exception of the gold, silver, copper, and other glasses which have a metallic sheen, the remaining tesserae are opaque and each has its color distributed uniformly throughout the mass. These opaque materials are virtually enamels. When a batch is melted, then the next step is to shape the molten stuff into rondelles or cakes of two thicknesses—that is, either of ⅕ or ⅖ of an inch. Again, in a modern plant, there are several pneumatic presses, and on the iron table of each are arranged some metal bars, of a suitable thickness, so



as to form a mold. A workman pours into the limited area a ladleful of molten glass dipped directly from one of the glowing pots. While the glass or enamel is still plastic, a whiff of compressed air forces a plunger down upon the material and flattens it into a cake of the thickness limited by the height of the confining metal bars.

From the press each rondelle or cake is carried hot to an annealing furnace, the temperature of which is at a maximum at the receiving end and drops to about that of the atmosphere at the discharge end. Depending upon the thickness of the cake, it remains in the annealing furnace from three to four days during its journey from intake to outlet; and that stay serves to remove any internal stresses that might later cause the glass or enamel to crack or to break unevenly when being handled by the mosaists. Because mosaics may be exposed to a considerable temperature range, it is necessary that the tesserae shall be but little affected by heat and cold. Therefore, the composition contains enough borax to insure a low coefficient of expansion. Furthermore, considerable lead is added to each batch to make the rondelles fracture cleanly when cut into tesserae or when the tesserae have to be chipped to shape them to meet some special need of the mosaist.

The majority of the tesserae will be produced at the glass plant. Lines at right angles are scored on one surface of a rondelle with a glass cutter, and a sharp tap is usually sufficient to cause the material to fracture along the scratched lines. The fracture in the case of the opaque material is just irregular enough to give a slightly broken reflection of light. This is a virtue, because it makes for a vibrant tone that is different from one produced by an area of pigment of the same basic color laid on with a brush or palette knife. In other words, each little tessera reflects a number of hues, although the chosen one predominates, and this is one of the reasons for the distinctive charm of present-day mosaics. The fractured surface of a tessera is the one presented to the beholder.

Most tesserae originate in the manner described; but mosaists obtain some of their richest effects by using tesserae that have metallic lusters. In their case the process of manufacture differs from that already outlined—the general procedure being as follows: Very thin sheets of glass are carefully blown, and gold leaf, for instance, is affixed to one surface. Next, the glass, with the metal film upmost, is laid on the table of a press and a ladleful of molten glass is poured on it and fused to it by pressure. The thicker sheet thus added becomes the foundation for the metal-film glass, and is not visible in a mosaic unless that glass is purposely colored to transmit a desired tone through the gold or silver leaf. Textured surfaces of varying patterns are given the metallic tesserae by placing the thin filmed sheet, with the film side up, on an iron plate having a suitably modeled surface. Again, a ladleful of incandescent glass is poured upon the thin sheet and pressure applied. The heat softens the glass so that it will receive the impress of the underlying plate; and, at the same time, the two sheets of glass become one with the metal leaf interposed. By adding color to the clear, thin glass very rich and beautiful effects are obtained when light is reflected from the underlying metal. The glass overlay is virtually a protecting glaze that keeps the luster of the metal leaf undimmed indefinitely.

Thousands of bits of glass are formed and placed in making a large mosaic.

When the great mosaic, "Intelligence Awakening Mankind," is in its permanent position, it will represent the combined efforts of Barry Faulkner and Ravenna Mosaics, Inc. The latter widely known and experienced concern is making both the tesserae and the mosaic, itself, in its Long Island City studio. The original sketch prepared by Mr. Faulkner is in color, and on a scale of 1 inch to 1 foot—that is, 6 feet 7 inches long and 1 foot 2 inches wide. His next task was to make a colored enlargement one-third full size; and his final product is a full-size black-and-white cartoon—the immediate guide for the mosaists. This cartoon was prepared by photographing sections of the colored enlargement and then solar-printing them to the full scale. The solar prints were strengthened and finished by Mr. Faulkner. These enlargements are mathematically exact. With the one-third-scale colored drawing and the big cartoon sections at hand, the craftsmen in the studio of Ravenna Mosaics, Inc., were ready to start the fabrication of the mosaic.

The first step at the studio was to trace parts of the design on transparent paper, using a soft crayon for this purpose, and then to transfer the lines, in reverse, on heavy paper by turning over each tracing and rubbing it with sufficient pressure. On the back of each of these heavy sheets, when properly assembled, were drawn sweeping control lines—usually undulating. These lines must register when the mosaic is mounted on the wall, section by section. Finally, each of the major sections of the cartoon was cut up into several irregular unit areas, like the parts of a picture puzzle; and each of these was given a distinguishing number. These small sections have an individual expanse of from 1½ to 2 square feet. The numbers and the control lines will guide the workers when the time comes to place the mosaic in Rockefeller Center.

With these preliminaries disposed of, the small sections are distributed among the mosaists, and each worker lays his sheet on

Above and left—With a 2½-pound hammer and a sharp-edged anvil the mosaist shapes the glass tesserae to meet his requirements.

Barry Faulkner, noted American artist, strengthening the lines of solar prints of his mosaic for Rockefeller Center.

his bench. The tesserae are assembled on the upturned surface, and the artisan looks at the back of the mosaic as he produces it. The craftsmen have Mr. Faulkner's large colored design to guide them in choosing the tesserae for their various hues. Perhaps, certain special parts of the design will be developed full-size and colored in the studio to help the workers carry out the artist's idea more faithfully. There will be between 500 and 600 individual sections. The number of men engaged will vary; and the work is being apportioned among them in accordance with their respective expertness—faces, hands, feet, etc., being turned over to those most skillful in reproducing them.

The foreman has to see to it that each mosaist has an ample quantity of tesserae of the required colors; and these are drawn from stock made up of from 4,000 to 5,000 shades—each numbered and kept in its own compartment. The foreman and the mosaists have keen eyes for color. Each little block is of the same shade throughout; and where a graduated effect is desired, the tesserae must be arranged so as to avoid any discordant break in the form suggested by the color. One by one, a mosaist places his tesserae in lines or groups, as the case may be, dabbing the paper with paste just before setting his bits of material. The paste is made of boiled rye flour to which is added some glycerine to slow up the drying of the paste. If the tessera be a bit of colored enamel, the surface laid against the paper will be a virtual duplicate of the paper surface seen by the worker. If the tessera be of metal-film glass, its upturned surface will be that of the heavy backing glass, and will have but little of the luster which will be visible when the mosaic is installed. The craftsman allows for this and gauges the effect accordingly. The mosaist sets each little piece on the paper far enough from its neighbors to leave narrow channels between them. These channels are later filled with mortar so as to bind the tesserae to the wall.

The mosaist takes some liberties with the colors in the original design, and he does this so as to heighten or to enrich the effect by making the most of the distinctive characteristics of his materials. Where the artist shows a considerable expanse of flat color, the mosaist does not use many small units of the same color. He employs tesserae not only of varying shades of the given color but he utilizes some of even different hues. At a distance, the coloring appears uniform, although composite, and the eye is intrigued without knowing why. A true mosaist abhors flatness: his aim is to make the most of broken light and a shifting but formless distribution of color. In this way he obtains a vibrant, arresting, and charming effect—something that marks the mosaic apart from other mural decorations. The artist who is familiar with the interpretive cunning of the mosaist usually gives that artisan freedom of self-expression, knowing that the ultimate result will be the finer on that account.

Most of the tesserae will be about ½ inch in length and a little less than ⅜ inch in width; but the mosaist may have to reduce them or give them other shapes. For this work his tools are an anvil and a hammer. The anvil is of steel, and has the appearance of a chisel set up in a working table consisting of an upright log large and heavy enough to insure space and steadiness. Each end of the hammer head has the form of a sharp and broad edge at right angles to the handle axis. When a tessera is held on the anvil, a light, quick tap of the hammer suffices to produce a clean fracture; and a mosaist thus fashions a tessera into any desired form with a few deft strokes.

When several unit sections have been finished for a given area, they are brought together on the floor of the studio. Then they can be examined from different angles and

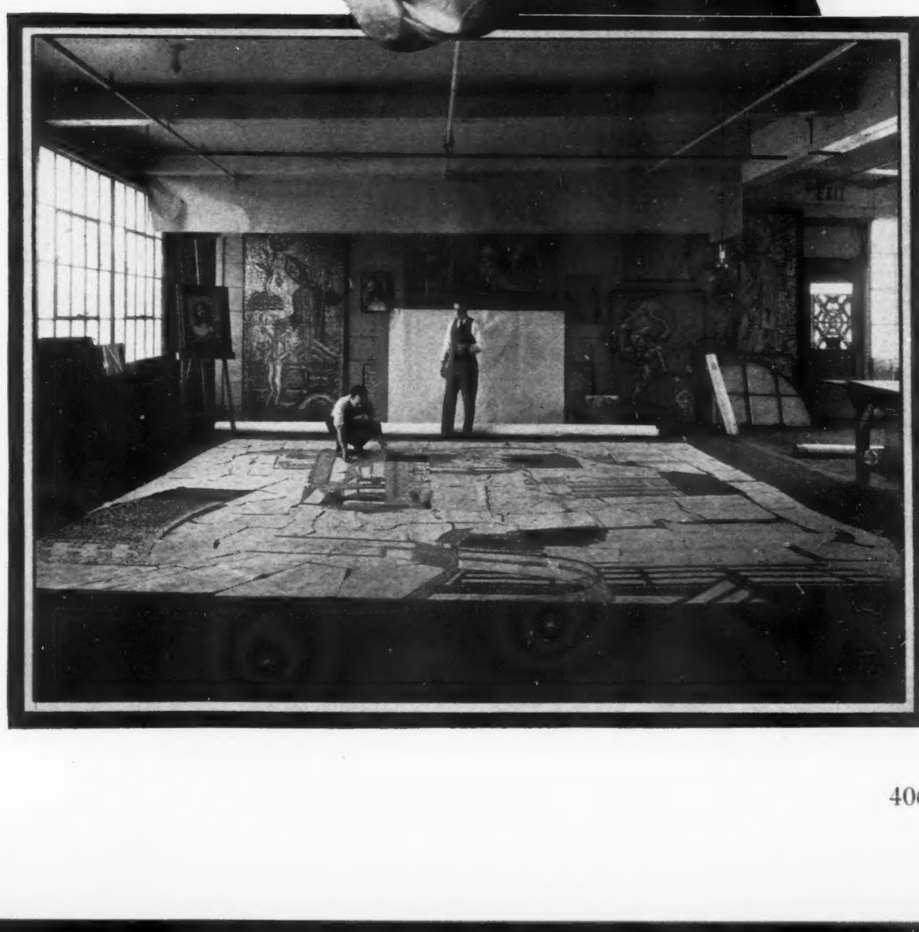
Above—Pasting bits of tesserae face down on a part of the design.

Center—Working plan of a large mosaic that serves as a guide in placing the several parts when completed. Bottom—Finished and unfinished sections of a mosaic laid on the floor for inspection.

under changing light conditions. Defects or unpleasing effects can be detected and promptly corrected. Large expanses of the mosaic can be examined in the same manner under the expert eyes of the men in the studio. Before the Faulkner mosaic is finished, the artist will pass upon it; and he knows from experience that pleasurable surprises are in store for him. The fashioning of the mosaic will take about 3½ months.

How will the mosaic be set in the loggia wall of the RCA Building? The procedure, although simple, calls for the exercise of much care. The installing will probably proceed from the bottom of the panel upward. Several square feet of the wall will be coated with cement-lime mortar ½ inch thick. The mortar will take four or five hours to set. This period permits of readjustment if anything should go wrong while placing a section. One by one, each numbered unit section will be pressed against and into the mortar—the supporting paper holding the tesserae the while; and the mortar will fill all the little channels and be in contact with the back of each tessera. Thus, the mosaic will grow; contiguous sections will fit one another to a nicety; and the control lines on the outer face of the paper will guide the workers. The men will purposely press some of the tesserae a trifle farther into the mortar than others to produce a slightly uneven surface. This will cause indefinable shades, not shadows, that will prevent flatness and give added charm. When the mortar has set so as to grip the tesserae, then the supporting paper will be dampened, after which it can be stripped off easily.

Should the mortar not fill all the little channels between the tesserae, or if its tone



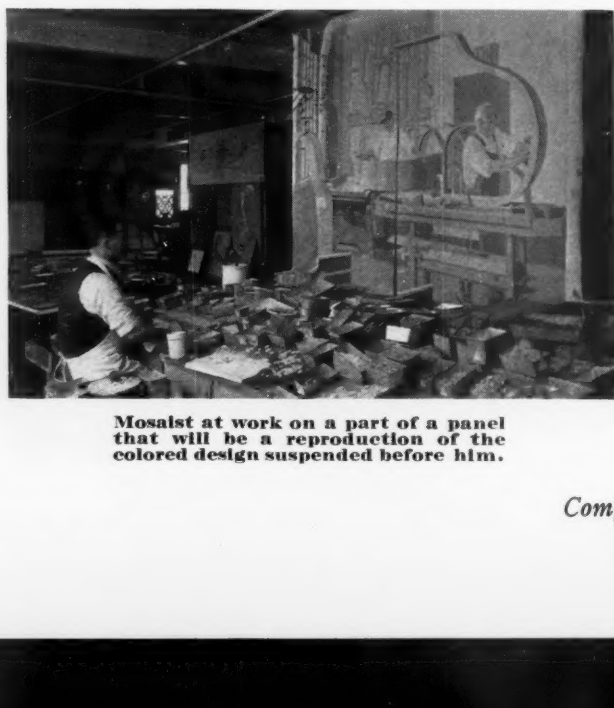
Sections of a big silhouette mosaic being packed for shipment.

be too light or too dark anywhere, the interstices will be cleaned out just enough to refill with a mortar of a suitable shade or color. In this way, the effect of the tesserae can be intensified or moderated. The installation of the Faulkner mosaic will consume from three to four weeks; and even a stranger to the craft will be able to grasp how precise must be the adjustments to bring together the hundreds of sections so that lines and curves will register without a single discordant break. The Faulkner mosaic is a "full mosaic," and every square inch of it will consist of tesserae. A "silhouette mosaic," on the other hand, is only partly modeled, and the background and even parts of it are made of mortar suitably colored to harmonize with the design worked out with tesserae.

The ancient mosaist created his works right on a wall or ceiling after outlining his figures in the plastic mortar. Bit by bit, his design grew, and he often labored in a bad light and in cramped and awkward positions. Only after he had finished his mosaic could he judge of his success—after the scaffolding that had supported him was removed. Disappointment was often his reward. Manifestly, the modern mosaist is favored, and his work reflects this. Furthermore, the processes now used by him make for efficiency and for lower costs.

From a practical point of view—not neglecting its wealth of beauty and its distinctive merits, a mosaic has much to commend it. Unlike mural paintings, mosaics are virtually imperishable and will last as long as the structures they adorn. The colors of the individual tesserae are unfading. Should dust or grime dim them, their surfaces have only to be cleaned with brush and water to make their charms stand forth again in all their pristine freshness. These facts explain why architects are turning more and more to mosaics to supply cheerfulness, colorfulness, and beauty to the walls and ceilings of public institutions, business structures, churches, theaters, railroad stations, and other notable edifices.

What more appropriate, then, than that Rockefeller Center should have among its wealth of artistic expressions a great mosaic symbolizing "Intelligence Awakening Mankind?" Surely, there is every reason why the significance of this message should be made as enduring and as perennially fresh in its impressiveness as possible. Perhaps it was for this reason that a magnificent mosaic was chosen.



Mosaist at work on a part of a panel that will be a reproduction of the colored design suspended before him.

TELEPHONE HAS ROBBED DEATH VALLEY OF ITS ISOLATION

DEATH Valley, that desolate and blistering-hot desert spot in the United States that has, until the advent of the automobile, been avoided by all but the fearless prospector in quest of mineral riches, is in easy touch today with the entire world. Linemen have encroached upon the region and have linked up Baker and Furnace Creek Inn, Calif., with a telephone system 110 miles long. This system was inaugurated not long ago, and the first call was fittingly sent to a veteran prospector, mule driver, and miner—"Johnnie" Mills, who has lived in the valley since the "nineties." For years the only means of communication with Death Valley was a railroad telegraph line.

The circuit was constructed at a cost of $25,000 through the coöperation of the Pacific Coast Borax Company and the Southern California Telephone Company by men of the Tonopah & Tidewater Railroad, which is also to be in charge of its maintenance. It called for the use of 60,000 pounds of copper wire and 2,500 special heat-resisting glass insulators—the latter being required because of the extreme temperature changes in the desert. The plan is to extend the system northward into the valley as the demands for the service increase.

Left—A group of men, prominent in subaqueous circles, aboard the "Explorer." Left to right: Tom Dunbar, diver; Simon Lake, inventor of the submarine; Dr. William Beebe, naturalist; Frank Crilly, diver.

Below—The "Explorer" comes to the surface.

Acme

Toy Submarine to Explore Neptune's Realm

THE submarine was invented for peaceful pursuits; but it proved such an effective instrument of warfare that its original purpose was all but forgotten. Initial conceptions have been somewhat revived now, however, by the construction and successful demonstration of a diminutive submergible which is designed to give access to all that portion of the ocean floor which is covered by 300 feet of water or less. The sponsors of this toy underwater craft advance the theory that it will open up a vast field of commercial endeavor and measurably add to the wealth of the world.

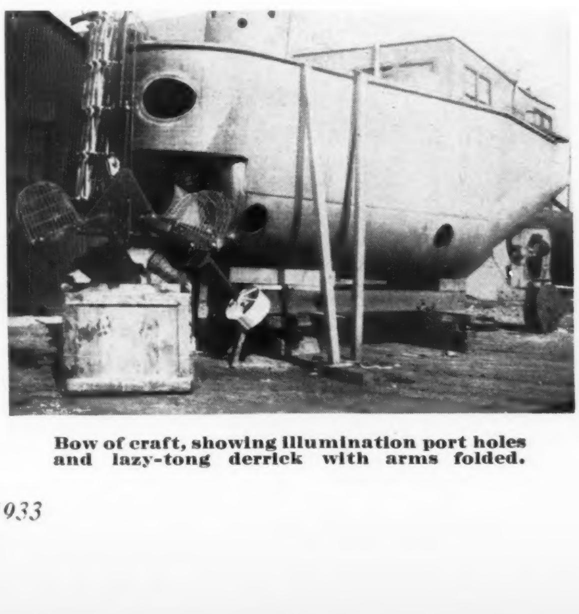
The new submarine is the creation of Simon Lake, pioneer American builder of subaqueous equipment. It has been aptly named *Explorer*. It is 22 feet long, has a 6-foot beam, and weighs 20,000 pounds. It normally carries a crew of two, but two more can be accommodated. It is designed to accomplish virtually all that is now done by divers and to do it under conditions that will enable men to work more steadily and to be relieved of the hazards that accompany underwater ventures. A field of use that is expected to prove lucrative is the harvesting of shellfish, pearl oysters, and sponges. Another prospective service is that of locating sunken ships and of assisting in the recovery of treasure aboard them. It is also believed that boats of this type will be valuable aids to undersea construction work and to scientific research.

The midget submergible ordinarily works in conjunction with a mother ship on the surface. From this larger boat it receives its compressed air and electric current through connecting lines. It can, however, be self-sustaining for periods up to 48 hours in case of need.

The *Explorer* has wheels on its hull which enable it to move along the ocean floor. Although normally towed by the mother ship, it has a 7½-hp. electric motor which will propel it either sideways or ahead. Provisions are made for balancing its buoyancy with such delicacy that it can float through the water close to the bottom but above any projecting rocks, reefs, or other obstructions. Clear vision in all directions is afforded by 22 windows in the hull and conning towers, and ample light is assured by two 5,000-watt searchlights which can be trained wherever illumination is desired. With their aid it is possible even to take photographs. At the bow is a folding derrick known as a "lazy-tong," which is fitted at its end with a grab bucket. It has a reach of 8 feet and can lift 500 pounds at a time.

As the fresh-air supply is obtained through a line from the surface, and as the stale air is exhausted through another line, it is possible to maintain normal atmospheric pressure within the vessel and thus remain submerged for hours at a time. Whenever a diver wishes to leave the submarine, the air pressure within it is raised to a point sufficient to offset the hydrostatic pressure at that depth. A hatch in the bottom of the hull is then slid open and the diver steps out. The hatch stays open and the submarine acts on the principle of the diving bell. The vessel can keep near the diver and can maintain communication with him by means of a telephone.

When the diver has finished his work, he can return to the submarine, where the air will gradually be restored to normal pressure. This is counted as one of the most desirable features of the new craft. Under present methods, a diver that goes down 200 feet, where the pressure is 86 pounds greater than normal, must dangle uncomfortably at the end of a cable while he is being raised, a few feet at a time, so that he will suffer no ill effects from too rapid a decompression. It is a slow and undesirable process at best. While the same period will be required for decompression when using the submergible, the diver will be comfortable and warm during the process, which will be controlled by the crew of the vessel. The greatest depth ever attained by a diver is 312 feet, where the pressure is of almost crushing intensity. Sustained labor at such a depth is out of the question. A craft like the *Explorer*, however, can make observations possible with the crew under normal pressure.



Bow of craft, showing illumination port holes and lazy-tong derrick with arms folded.

The baby submarine will be able to roam 1,000 feet or more away from the mother ship by providing connections of suitable lengths. The vessel submerges by admitting water to its ballast tanks, and the descent may be

checked at any point. A surface buoy is used to notify the mother ship should the submarine, while exploring the sea bottom, drop off a cliff or suffer some similar calamity. This buoy is connected to a windlass on the deck of the parent ship.

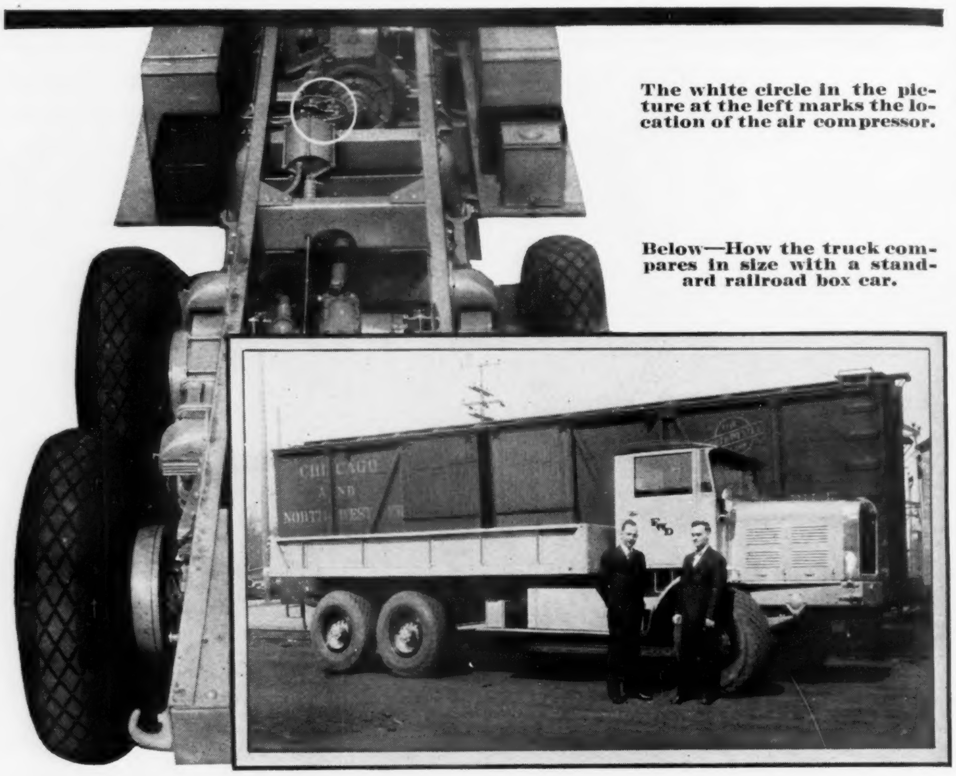
The submergible rises by blowing water from the ballast tanks with compressed air. The air normally comes through the line from the mother ship, but tanks of high-pressure air are carried aboard the underwater craft for emergency use. These tanks will supply air to maintain life aboard the craft for 48 hours—chemicals being provided to absorb the carbon monoxide from the vitiated atmosphere.

Some 9,000,000 square miles of ocean bottom are under less than 300 feet of water, according to Mr. Lake; and his new invention will permit of commercial exploitation of any of this vast area. Virtually all the Atlantic Ocean 50 miles offshore between Cape Cod and Cape Hatteras is included in this domain. The region is one rich in shellfish; and Mr. Lake declares that some of it will yield as much as $3,000 to the acre from this source. He claims to have seen clams 8 inches long which can be easily procured with the drag bucket but which are so embedded in the bottom as to defy the "blind" efforts of trawlers and dredges working from the surface. It is pointed out that sponges can be cut off near their roots, enabling new growth to take place, instead of tearing them from their places of attachment as under present practices.

The possibilities of the small submarine in the realm of locating sunken ships and salvaging valuable cargo from them will no doubt have a greater appeal to the popular imagination than the more prosaic activities of gathering shellfish, pearls, and sponges. There are hundreds of lost vessels in relatively shallow waters containing valuables which cannot be profitably or safely recovered by traditional methods. During the trial trip of the *Explorer* in Long Island Sound, fourteen sunken craft of various types were located.

It is felt that the new type of submergible will be helpful in laying subaqueous conduits and cables, in inspecting piers and cribs, and in conducting surveys of harbors and coastal waters. Scientific expeditions will find it useful in studying aquatic life and in making underwater motion and still pictures.

The *Explorer* has a double steel hull. The inner one is of cylindrical form to afford maximum resistance to water pressure. The outer shell is shaped to give the boat desirable form for navigational purposes. In the space between the two hulls are the water tanks for submerging; and there are additional tanks fore and aft to control maneuvering and to establish desired balance and buoyancy.



The white circle in the picture at the left marks the location of the air compressor.

Below—How the truck compares in size with a standard railroad box car.

Truck Carries Compressor to Inflate Tires

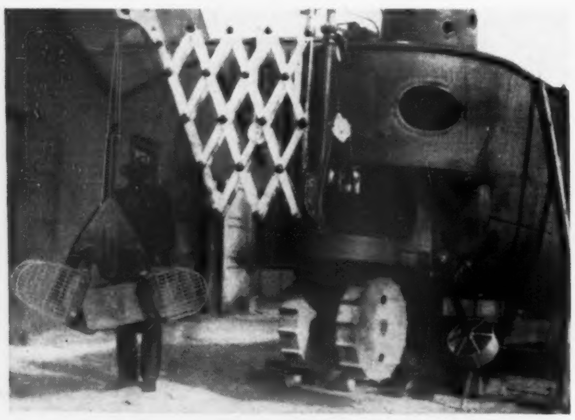
A TRUCK which carries its own air compressor for the inflation of tires is a new development in heavy-duty vehicles designed for service in inaccessible regions where weighty materials must be moved over poor roads and heavy grades. Such a truck has been made by The Four Wheel Drive Auto Company of Clintonville, Wis., and is engaged at Haifa, Palestine, in hauling equipment on the $40,000,000 pipe-line project of the Iraq Petroleum Company. It has a capacity of 15 tons and is equipped with 6-wheel drive.

As one of the accompanying illustrations shows, the compressor is mounted just behind the transmission. It is driven by the truck motor through the regular power line—provision being made for throwing gears into mesh for that purpose when air is desired. The compressor is a 2-cylinder, air-cooled model.

This huge truck has many unusual features. Six-wheel drive is secured through three double-reduction axles. The two rear axles are coupled together and suspended from a heavy cross shaft which serves as a pivot. Eight forward speeds and two reverse speeds are available to the driver. Gear reductions range from 8.36 to 1 in high speed to 173 to 1 in low. There are two independent sets of 6-wheel air brakes that act directly on the drums of all the wheels. The emergency brake is of the shoe-and-disk type.

Because of the extreme heat and the sparsely settled character of the region where this truck is at work, special provisions were made for insuring ample supplies of gasoline, oil, and water. In addition to the regular 40-gallon gasoline tank beneath the driver's seat, there is a 65-gallon reserve tank on the right-hand running board. A tank of similar capacity on the left-hand running board is for water storage. A 6-gallon reserve oil tank is also installed.

As tested at the factory over virtually all types of roads that it might be likely to encounter in service, the truck has a gross weight of 51,000 pounds, or 25½ tons. Following the tests, it was partly dismantled and crated for shipment abroad. A factory representative accompanied it to assemble it at its destination.



Derrick extended and grab bucket open. Note front wheels for traveling along the bottom.

Portable Mine Loader for Use in Close Quarters

A. M. HOFFMANN

A PRACTICAL mining man, fully alive to the needs of his calling, has given the industry a new loading machine that from all reports is living up to the claims made for it. The shovel is the invention of J. S. Finlay, superintendent of the North Lily Mining Company near Eureka, Utah, and was designed primarily for work in close quarters either above or below ground. It is being manufactured under the name of Eimco-Finlay Loader by the Eastern Iron & Metal Company, Inc., of Salt Lake City, Utah.

In his aim to produce a portable shovel of modest dimensions that would be sturdy enough to stand up under hard usage and easy to handle, the designer has apparently been successful, judging by the accounts of users both in the United States and abroad. The loader has an over-all length of 42 inches, or of 63 inches with the bucket extended; is 30 inches wide; 68 inches high with the scoop lowered; requires a maximum headroom of 74 inches; and has a digging radius of 84 inches. It is, in fact, just about as large as a 16-cubic-foot ore car, and can be operated in a space 4 feet wide and 6½ feet high.

There is no need here of entering into all the machine's structural details. It suffices to say that it is built of special alloy steel; has few moving parts; is constructed so that it can be adjusted without much loss of time to travel on tracks of 18-, 20-, or 24-inch gauge; and weighs, completely equipped, 3,200 pounds. This weight, however, can be increased by as much as 1,600 pounds when loading heavy, sticky ore or when operating on an incline. For this purpose the 1-piece underframe has hollow ballast sockets.

Power to propel and to crowd the shovel—the latter an outstanding feature of the machine—is provided by a 5.5-hp. Ingersoll-Rand air motor. Another motor of the same make and capacity furnishes the power for loading, lifting, and dumping the bucket. Each motor is fitted and keyed into position in such a way that it remains securely in place no matter to what rough usage the shovel is put, and both respond to the movements of quick-acting throttles which, for convenience, are located on one side of the machine where there is also a platform on which the operator stands when at work. This platform and the air manifold are removable so that the loader can be shifted from one level to another by means of any standard mine cage not less than 30x42 inches in size. A heavy wire screen, likewise removable, protects the mucker from falling rock.

After a mine car has been run against the shovel—the coupling being effected automatically—the latter is ready to start work. With his left hand the operator manipulates the control that causes the unit to move forward and backward on the rails and crowds it into the muck pile. This control consists of a sleeve surrounding the handle that is used when the scoop, mounted on a ball-bearing turntable, is to be swung to the right or left in cleaning up alongside the track or in side digging. It might be mentioned here that the Eimco-Finlay Loader is said to be the only one of its kind that can quickly clean up its own track and handle shallow muck. The throttle that controls the movement of the bucket from standstill to dumping and reverse is within convenient reach of the right hand. The entire arrangement is such as to make for ease and speed of operation. When full, the car is released by tripping the coupling lever and can be started on its course down the track by a push from the shovel running in reverse. The loader can also be utilized for tramming and switching, doing both services under its own power within the limits of the connecting air hose. Beyond that point, however, it has to be shoved by hand, the traction motor being disengaged from the wheels for that purpose.

According to the manufacturer, the shovel will load a 16-cubic-foot mine car in from 30 to 45 seconds, which is equivalent to a capacity of from 40 to 60 tons per hour, depending upon the conditions under which it must operate and the car service that can be maintained. In a large lead-silver mine it has been able to take care of as many as 60 to 80 cars at a single face in from 2½ to 3 hours. Working on one level with four or five adjacent headings it has loaded 200 cars in eight hours, allowing sufficient time for a round a shift at two headings. This was done with the assistance of one operator and two trammers who had to move the cars an average distance of 250 feet to a double switch accommodating from ten to twenty empties. Besides handling the muck, the three men had to lay and shift the rails and ties at the various headings.

As working conditions in no two mines are alike, no hard and fast cost figures can be given; but the following reports from several large producers who are using Eimco-Finlay loaders are suggestive: During a period of two months in a mine of the United States Smelting, Refining & Mining Exploration Company, Utah, a shovel of this type loaded from 5,500 to 6,000 tons of quartzite and limestone, breaking 20 cubic feet to the ton, at a cost of $0.22525 per ton, or at a saving of $0.13475 as compared with hand labor. Two men constituted the mucking crew, one to operate the shovel and the other to tram the cars; and the rock was loaded in 16-cubic-foot cars in an untimbered straight drift 6 feet wide and 7 feet high.

In a mine of the Combined Metals, Inc., Utah, the shovel has handled 2,100 tons of shale and limestone, running 19 cubic feet per ton of ore broken, at a cost of $0.26 a ton, as against an average cost of $0.34 for hand loading. In this case the drift was 5½ feet wide and 7 feet high; the cars had a capacity of 19 cubic feet; and only the shovel operator was included in the cost figures. The management of this mine has made the statement that the unit will be able to handle

30 tons of rock an hour in a $5\frac{1}{2}$x7-foot drift as soon as loading conditions are ideal.

The machine has proved effective not only in large properties but also in prospects where short tunnels have to be driven. A case in point is a 600-foot tunnel, $8\frac{1}{2}$x$9\frac{1}{2}$ feet in cross section, which was run with the assistance of an Eimco-Finlay loader in less than 60 days by the Four Square Gold Syndicate in the Coeur d'Alene district. This work was done with four men. According to Mr. Harry P. Pearson, president of the syndicate, "Any company figuring on doing any amount of tunneling should certainly have an Eimco-Finlay loader."

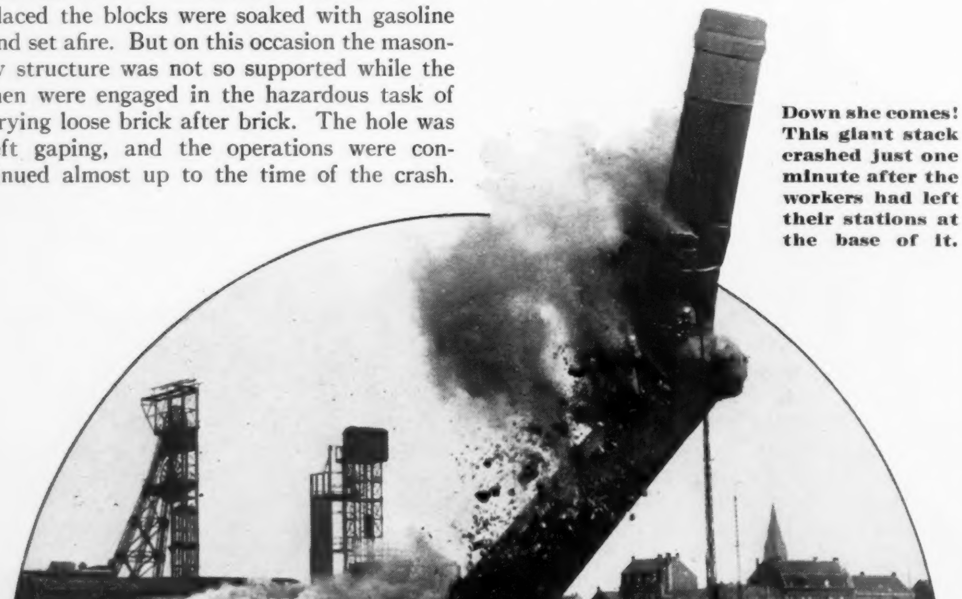
Regarding the shovel's performance in the North Lily Mine, Mr. Finlay has said: In fifteen months' service, one machine has handled 20,000 tons of limestone, shale, and quartzite—breaking approximately 20 cubic feet to the ton—at a total cost of ten to twenty cents a ton, which is about 30 per cent of the hand-loading cost. It is used in driving drifts and crosscuts 4x7 feet and more in size; and cars with a capacity of 16 cubic feet are utilized. These are moved by hand from the motor haulage switch to a portable 1-car switch that slides along the track and is kept conveniently close to the face, an arrangement that makes for quick car changes and speeds up the loading as much as 25 per cent. A typical heading yields from 27 to 35 tons of rock, which is loaded into from 35 to 45 cars in about $1\frac{1}{2}$-hours—the shovel being in operation about 60 per cent of the entire mucking period. Three men—the runner, a miner, and a trammer—comprise the shovel crew. Unskilled labor can be trained to do this work with equal facility in from two to four weeks' time.

Stack Felled by Daring Method

IN demolishing the last and tallest of the smokestacks on the property of the Hibernia Works in Gelsenkirchen, Germany, the wreckers, M. Stern A.G., of Essen, introduced a departure in practice that, on the face of it, appears foolhardy, but which functioned as planned. Nothing untoward happened, and the 227-foot chimney was brought to earth in less time than by the method previously employed by that company.

The work required to fell the towering structure consisted in making a large enough opening in the masonry at the base of the stack to destroy its equilibrium. This was done by the aid of paving breakers. Heretofore, as fast as a brick was removed, a wooden block was inserted to fill the space, and when a sufficient number of them had been thus displaced the blocks were soaked with gasoline and set afire. But on this occasion the masonry structure was not so supported while the men were engaged in the hazardous task of prying loose brick after brick. The hole was left gaping, and the operations were continued almost up to the time of the crash. All that stood between the men and safety were a sheet of paper, that was pasted on the inner wall of the stack immediately opposite the point at which they were working, and a tube that was set up on end inside the stack. These were counted upon to give instant warning of the slightest movement on the part of the chimney.

When the first crack appeared in the paper, it was a signal for the work to cease and for the men to withdraw with all possible dispatch. Just one minute later, the giant stack came tumbling to earth. It might be mentioned here that the wrecking of such structures in the United States is usually effected by drilling holes in the base with air-driven tools and charging them with explosives.



Down she comes! This giant stack crashed just one minute after the workers had left their stations at the base of it.

Courtesy, Glueckauf.

FLOTATION REMOVES NOXIOUS WEED SEEDS FROM CLOVER

SUCH nonagrarian mortals as mining men would hardly be expected to aid the farmer with his problems, yet they have done so in Canada. Two members of the staff of the mining laboratory of the University of Toronto, Prof. F. C. Dyer and H. L. McClelland, have succeeded in separating various noxious seeds from clover seed by applying the principles of flotation. It is reported that agriculturists, who had been seeking an effective means of separation for many years, were amazed when the two mining specialists developed a satisfactory process so quickly. Seed dealers in Canada and in the United States are said to be keenly interested in the development, as it promises to be a solution of a very annoying problem.

Government seed graders are very strict, and the requirements are that noxious weed seeds shall not be present in clover seed in a greater ratio than about 1 in 20,000. The conventional method of cleaning clover seed has been by gravity separation; but as some of the objectionable seeds are of the same size, weight, and shape as seeds of the clover family, it has been extremely difficult to detect and remove them.

Messrs. Dyer and McClelland determined that weed seeds have a more pronounced "wetability" than clover seeds and that under properly controlled conditions of treatment they can be made to sink while the desirable seeds remain afloat. In its account of the discovery, the *Financial Post* of Toronto states: "Old methods were quite successful in eliminating all but such weed seeds as campion, white cockle, and catchfly. These three noxious weed seeds were so like the good seed itself as to almost defy separation by ordinary means; but by the application of flotation methods, similar to those used in separating minerals in ore, an effective process has been evolved.

"Mr. W. J. W. Lennox of the Seed Branch of the Dominion Department of Agriculture has the highest praise for the results attained by mining engineers who are not supposed to know enough about farming as to be able to tell which end of the cow gets up first."

Rare woods from Brazil, which were included in the first shipment to reach the United States from the Ford rubber plantation, will be utilized in the ornamentation of a new service branch of the Ford Motor Company, which is now being built at Alexandria, Va. It is also planned to employ some of the hardwoods for paneling the interiors of Lincoln automobiles. Two of the most beautiful of the species are the *Andiroba* and the *Castanheira*, which are said to excel hardwoods used today in the finest examples of American cabinetwork. The trees were felled during the clearing of the jungle for the rubber plantation; and part of the lumber from them has gone into the construction of the buildings and houses on the property. During the four years that have intervened, the woods have been studied both in South America and in Dearborn, Mich.

A History of American Mining, by T. A. Rickard. An illustrated volume of 414 pages, published by McGraw-Hill Book Company, New York City. Price, $3.00.

FEW men are as well qualified as Mr. Rickard to write a history of American mining, and fewer still could have done as good a writing job as he has done. His entire adult life has been spent close to the metal-mining industry, and he has visited every camp that has amounted to anything during that period. He is a searching, painstaking student of history, and he has the trained journalist's ability to sift the facts and to give prominence to those that are pertinent and interesting. The result is an authoritative work, full of meat, and garnished with human interest so skillfully that each page lures the reader onward. It is a book that gives names, dates, places, and figures, and it is bound to become a standard reference volume.

The 23 chapters take the reader to every important past or present mineral-producing area in the United States; and when the journey is ended he is sorry that it has not been longer. Owners and managers of mines have obviously supplied generous assistance, for the book digs deeply into methods and costs of production in leading properties.

Mr. Rickard dispels many myths that have arisen in connection with the discoveries of certain rich mines; but some of the true stories that he unfolds are more absorbing than the apocryphal accounts they displace. *A History of American Mining* is one of a series of books being issued by the American Institute of Mining and Metallurgical Engineers and made possible through the Seeley W. Mudd Memorial Fund. The book is dedicated to Herbert Hoover, "the most distinguished of American mining engineers."

Economics of Construction Management, by J. L. Harrison. A book of 330 pages published by the Gillette Publishing Company, 400 West Madison Street, Chicago, Ill. Price, $3.75.

APPEARING as it does at a time when construction enterprises are comparatively few in number and when bidding among contractors is abnormally keen, this exceedingly practical work should appeal to those individuals and firms whose business it is to build things of one sort or another. The author analyzes the various factors that enter into the cost of any construction activity and points out pitfalls into which the unwary contractor may plunge if he fail adequately to consider them. Mr. Harrison is a member of the staff of the Division of Management of the United States Bureau of Public Roads, a post which has given him unusual opportunities to study the matters of which he writes. His connection with construction enterprises covers more than 25 years of service in various positions in the field and office. Contractors, engineers, and all those who are charged with the responsibility of directing construction work will find this book both interesting and valuable.

The Working of Semi-Precious Stones, by J. H. Howard. A booklet of 37 pages, illustrated with drawings and halftones. Published by Rocks and Minerals, Peekskill, N. Y. Price, $1.00.

THIS is a practical guidebook for the person who wants to learn the rudiments of gem-cutting. It is intended for the amateur who seeks an interesting hobby. It does not pretend to fit one for professional work; but it teaches the procedure which may, in time, make one a skilled lapidary. Mr. Howard was impelled to write his pamphlet by reason of the fact that when he himself had sought such a reference work none had been available. The knowledge of gemcraft that he dispenses was gained in a basement shop which he fitted up in his home. The booklet tells how to make simple equipment and how to use it. The author places the over-all cost of outfitting a home workshop at less than $50. The writing is in simple, nontechnical language.

Prevention of Automobile Accidents, by Victor W. Page. An illustrated volume of 172 pages published by The Norman W. Henley Publishing Company, New York City. Price, 50 cents: cloth binding, 75 cents.

THE author prefaces his work with an admission that while no number of books will effectually prevent automobile accidents, individual drivers can materially decrease road mishaps if they will take pains to learn their cars thoroughly and to devote attention to maintaining them adequately and driving them carefully. The result is more than a book of rules: it is interesting and helpful reading for any motorist. Mr. Page is an automotive engineer who has contributed many books to the literature of his profession.

Stainless Steels and Their Uses is the title of a well-illustrated 20-page booklet published and distributed free by the Electro Metallurgical Company, 30 East 42nd Street, New York City. Besides listing the many things now made of stainless steels, the pamphlet also deals with the alloys, themselves, dividing them broadly into groups having different applications by reason of their chromium content.

Like its predecessor, the 1932 edition of *Railroad Facts No. 10* is a complete statistical record of the railroads of the United States. Anyone desiring facts and figures on this subject will find them conveniently tabulated in this 96-page booklet, which is published by the Western Railways' Committee on Public Relations, Chicago, Ill.

An illustrated booklet describing Vim Tred leather belting, a new development which applies the principles of automobile-tire treads to leather belting, has been issued by E. F. Houghton & Company. It is claimed that this "non-skid" belt greatly reduces slippage, increases pulling power, and gives longer service. Copies of the publication are obtainable from the manufacturer at Third, American and Somerset streets, Philadelphia, Pa.

Pneumatic Tabling of Coal; Effect of Specific Gravity, Size, and Shape is the title of Technical Paper 356 prepared by H. F. Yancey and C. P. Porter and published by the United States Bureau of Mines. It may be obtained for five cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

PERISCOPE MAKES WORK OF DRUM INSPECTOR EASY AND SAFE

METAL drums, barrels, and cylinders that are used over and over again in the transportation of paints, chemicals, fuel oils, etc., must be inspected periodically both inside and outside to determine whether they are in need of cleaning or repair. It has been a difficult matter in the past to get a good view of the interior of these containers. Sometimes it has necessitated cutting into a drum; and the use of the naked flame or electric lamp for illumination is dangerous practice.

The work has lately been made safe as well as easy through the development of an electric periscope that is inserted in the opening in the top of the container undergoing examination. By simply moving the instrument up and down and around its axis while he is looking through it, the user is able quickly and thoroughly to inspect the inner surfaces.

Courtesy Rock Products

Getting a good look inside with the electric periscope.